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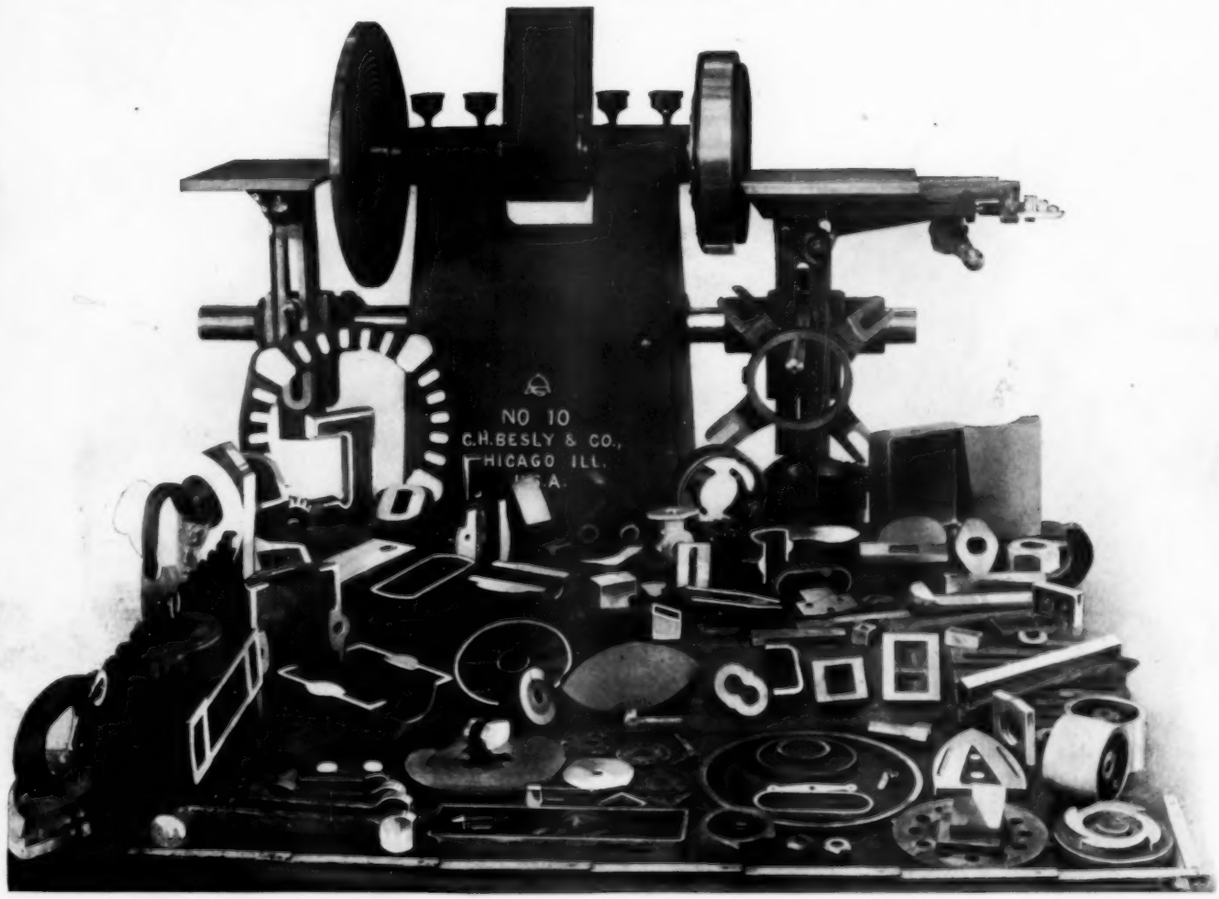

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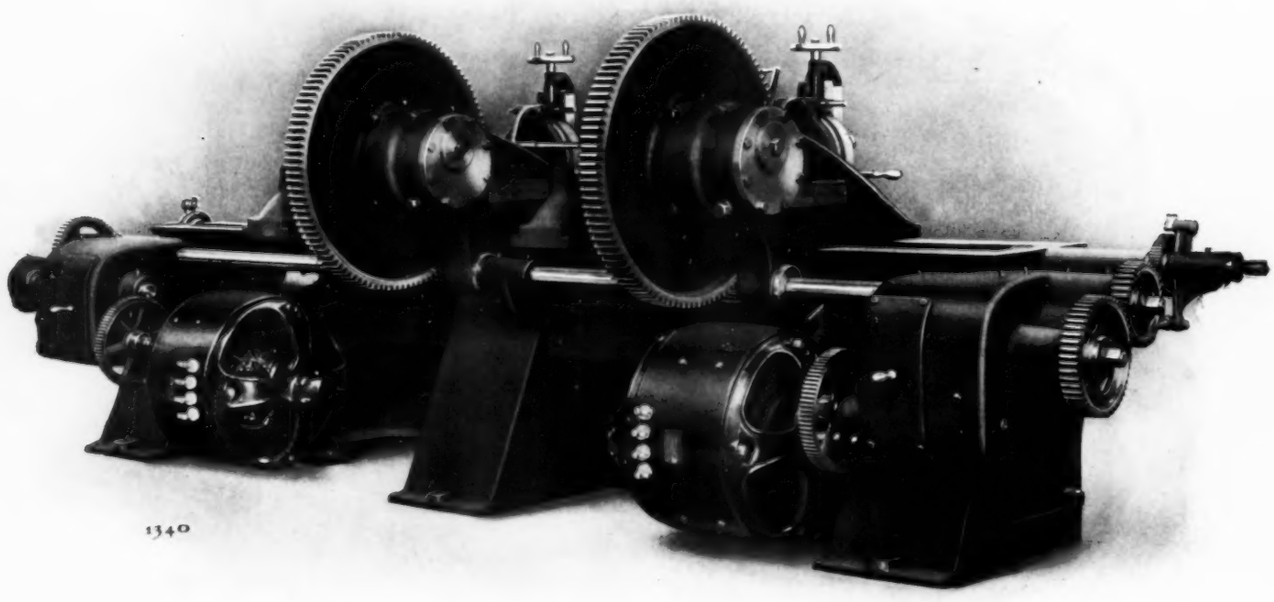

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Building Sawmill Machinery

By F. A. Stanley*

Methods in a large Minneapolis shop making big band saws and other mill machinery; also ways and means for machining gas traction engines and some other apparatus for farm work.

Erecting and machining large wheels; drilling and milling connecting rods; boring cylinders; planing and gear-hobbing operations.

*Western editor.

The Diamond Iron Works of Minneapolis, Minnesota, builds sawmill and special machinery, and handles a variety of jobbing work in its foundry and machine shop.

A general view in the main shop is presented in Fig. 1 which shows the central bay for about half of its actual length. As will be seen, the shop is of brick and steel construction, and well lighted from all points. A ten-ton crane traversing this bay serves the erecting floor and the heavy tools, and particularly the row of planers placed crosswise of the shop as shown at the right-hand side of the engraving.

Planing and Milling

Many of the castings machined here are of awkward form and some little ingenuity is required upon the part of the planer hands in securing and tooling such pieces satisfactorily.

Fig. 2 illustrates the method of facing off bosses on a cast-iron base for a large band saw. The work is done on a Cleveland open-side planer with a special extension arm which is attached at the rear to the cross-rail saddle while the front end of the arm carries the regular tool slide of the planer.

The casting on the planer in Fig. 3 is a knee for a sawmill carriage.

In Fig. 4 two "hog" anvils are shown on the Ingersoll four-head miller and a "hog" dish is seen at the rear, between the lathe centers.

The "hog" is a piece of sawmill machinery used for cutting up refuse for fuel and for cutting logs and stock into chips for distillation purposes. The "anvil" is an angular casting adapted to carry an adjustable knife face and the bevel-face disks are fitted with knives which shear past this face. An opening in the machine allows the refuse, or even a log, to be fed into contact with the revolving knives on the disks, where the material is rapidly reduced to chip form.

Fig. 1. Main Shop of the Diamond Iron Works, Minneapolis, Minn.

There are several surfaces on the anvils which require machining and in certain cases all four of the miller heads are brought into use simultaneously. It happens, however, that on the size of work illustrated only three of the cutters are employed at once.

Cylinder Boring

The steam cylinder in Fig. 5 is about 3 feet 6 inches long by 5 inches diameter inside. It is part of a band mill and is used for elevating and lowering the saw guide to accommodate the different sizes of logs. The Beaman & Smith horizontal machine in which the cylinder is bored has a very long spindle and bar and is used in this shop for boring various classes of cylinders of all sizes and up to 10 or 12 feet in length.

The cylinder illustrated has a pad cast at each end and is readily located and secured on the two adjustable supports. The boring heads are of the multiple-cutter type and several heads, including a number of sizes, are seen on the floor under the head of the machine.

A Large Band-saw Wheel

The pulley in Fig. 6 is for a large band mill and measures about 10 feet in diameter by 16 inches across the face. It is cast with steel spokes which are threaded at each end before they are placed in the mold. To prevent trouble during the shrinkage in the process of cooling, the rim is poured first, and the pouring of the hub is postponed until the following day.

Before boring out the hub the portable boring device is centrally located relative to the rim of the pulley by means of a tram which is swung around the boring-bar bearings and applied to the rim of the wheel.

After the boring bar is set central, it is belted from the jack shaft on the wall, and a series of cuts are taken through the hub. The bar is rotated by spur gearing from the drive shaft, and the feed is applied by means of differential gearing.

A single-point cutter is used for finishing the bore and the pulley is then swung in the pit lathe and turned off on its face.

A Built-up Tractor Wheel

The wheel in Fig. 7 is one of a pair for a large gas tractor for heavy farm work, and is built up of steel plate rolled into a ring reinforced around the inner edges and fitted with steel arms of rectangular section which are riveted to the hub flanges and to the inside of the rim.

The wheel is about 10 feet in diameter and after the rim has been drilled and bent up to a circle, four pairs of dummy arms with turnbuckle connections are

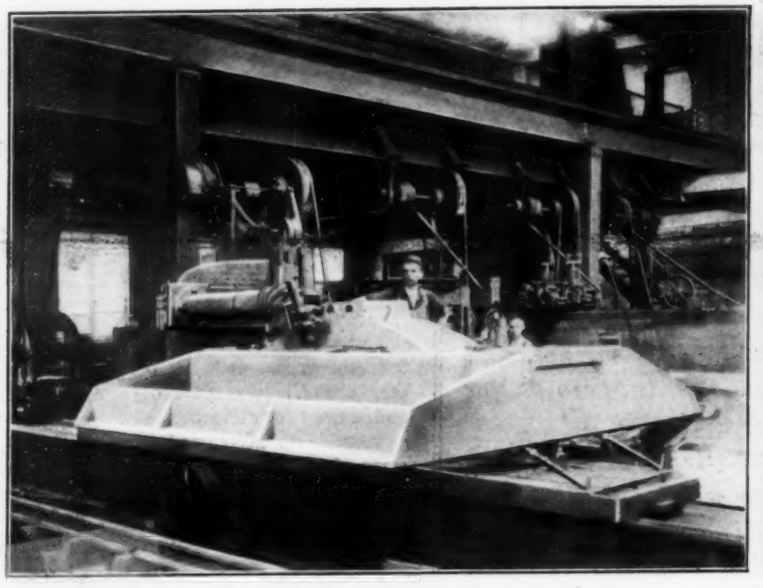


FIG. 2. A BAND-SAW BASE ON THE OPEN-SIDE PLANER

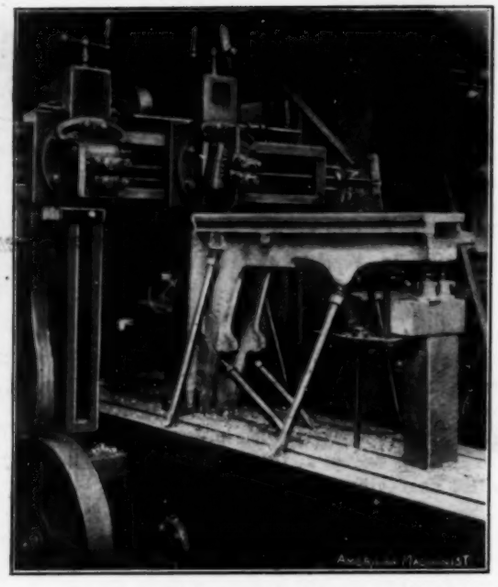


FIG. 3. PLANING A KNEE FOR A SAW-MILL CARRIAGE

bolted on quarters, to the rim and hub. The turnbuckles are then adjusted until the outside of the rim runs practically true, when the wheel is rotated on the shaft which is slipped through the bore of the hub.

After getting the affair trued up, the permanent spokes, which are upset at the ends and bent to the necessary angles, are slipped into position and riveted one by one, the temporary arms remaining in position until all of the other stations have been fitted with the permanent spokes, after which the turnbuckles are eased and the remaining arms riveted in place.

The riveting on of the series of V-shaped gripping members around the outside of the rim to prevent slip when the tractor is in operation, completes the preparation of the wheel.

A DRILLING JIG FOR CONNECTING RODS

Some useful jigs and fixtures have been designed in the shop for machining various parts of gas tractor engines. Fig. 8 illustrates one of these jigs, which is used for drilling the bolt holes in the large ends of connecting rods. The jig receives six rods at a time, after these have been bored at both ends, although in the photograph only two are seen in place.

The outer end or leg of the jig is connected with the body by two cap screws, in open slots at the end of the bushing plate, and a slight turn of the screws allows the loose end to be slid away from the jig to permit the series of connecting rods to be slipped over the ends of the two locating arbors. Setscrews at the end confine the connecting rods against side movement after they are slipped into place and the removable member of the jig is again secured to the jig body.

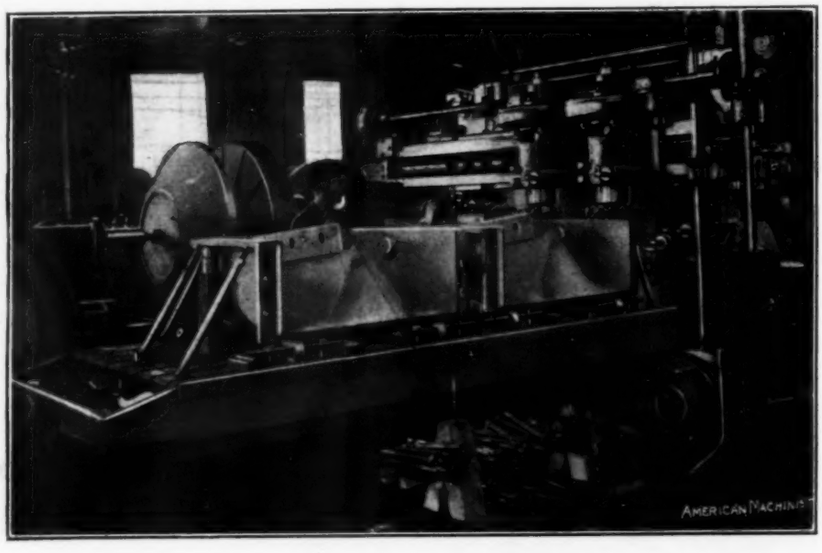


FIG. 4. MILLING AND TURNING OPERATIONS

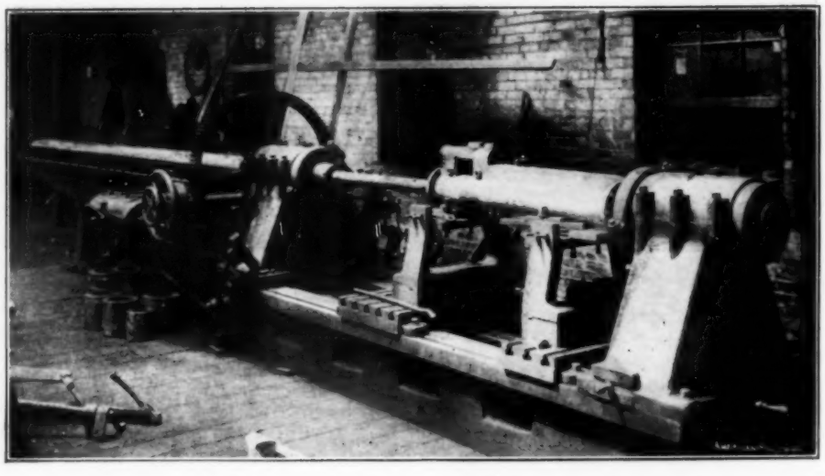


FIG. 5. BORING A STEAM CYLINDER FOR A BAND MILL

FIG. 6. BORING A LARGE BAND-MILL PULLEY

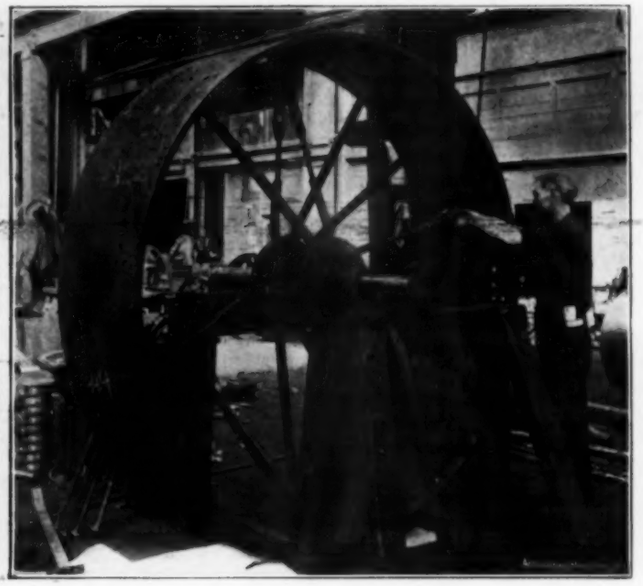


FIG. 7. ERECTING A BIG TRACTION-ENGINE WHEEL

While there are 24 holes to be drilled in the six rods, only 12 are drilled simultaneously as the multiple-drill spindles cannot be adjusted to such short centers as would be required if the entire series were formed at once. So 12 spindles are set to drill every other hole—that is, six on each side of the longitudinal center line of the jig. The latter is then slid along and the 12 spindles again brought into service to complete the other 12 holes.

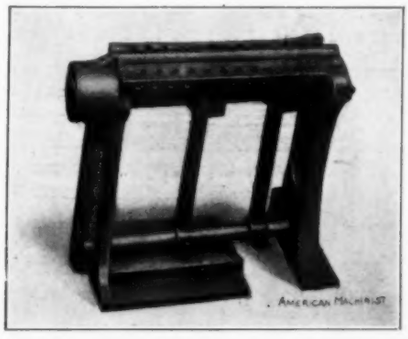


FIG. 8. DRILL JIG FOR CONNECTING RODS

MILLING CONNECTING RODS

Fig. 9 shows a miller fixture for finishing connecting rods, sawing the cap from the large end of the rod and splitting the small end. A finished rod is shown on the fixture and it will be seen that rod and cap are fitted with flanged boxes. These are of white bronze.

The milling fixture carries two arbors *A*, *B*, each of which receives four forged connecting rods. The outer ends of the rods are held on a smaller arbor as represented. There is a collar on the end of each arbor *A*, *B*, which is set up with a taper key to clamp the four rods against the fixed shoulder at the inner end of the arbors. The holding arbors are gripped in their seats by straps and milling cuts are taken to face off the heads of the rods in order to form the seats and shoulders for the cap-holding bolts. The cap has a hook-shaped lug which, as shown, is afterward drilled to supply oil to the bearing, and this lug is faced by milling in the same fixture.

After the slitting saw has been run across the string of rods, cutting the cap down to the bore, the pair of holding arbors and the eight connecting rods are turned over and the other side of the head split, thus completing the process of severing the cap. In the halftone the work is shown in position for the splitting of the small end of the rod also. When the work is removed from this fixture it is ready for the reception of the white-bronze boxes.

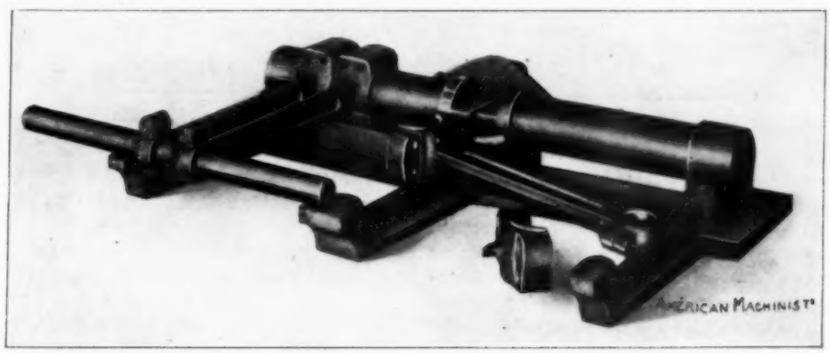


FIG. 9. FIXTURE FOR SPLITTING CONNECTING-ROD CAPS

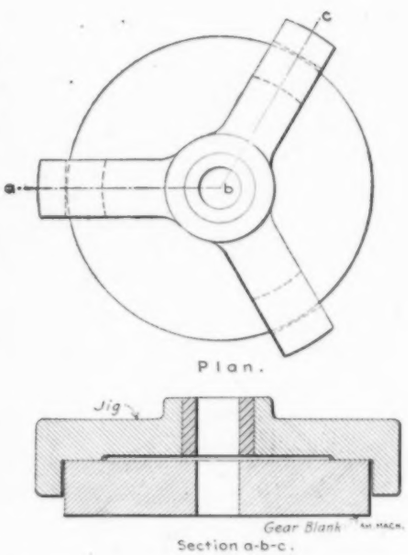


FIG. 10. JIG FOR DRILLING GEAR BLANKS

OPERATIONS ON GEARS

This company manufactures a line of "pump jacks" which constitute a piece of farm apparatus used for transmitting motion from a gasolene engine to a farm pump. It consists of a base carrying a rocker arm and suitable gearing and while ordinarily these gears are formed with cast teeth, it is the practice of this firm to cut the teeth of all such gears.

The gears are handled economically in the following manner:

First, the cast blank in the form of a plain disk is slipped into a skeleton jig, Fig. 10, where the hole at the center is machined. The blanks are machine molded and come from the foundry so close to size that the jig will drop over the edge without shake and without requiring to be clamped.

After the periphery of the blank has been ground off by hand application on an emery wheel in order to remove the scale, a string of blanks are placed on an arbor and the teeth cut in a gear hobber.

Although the outside of the gear runs out more or less, due to its unfinished condition, it is, of course, true on the pitch line and the gears thus run together satisfactorily in practice even though no time is spent in machining the blanks before placing them in the hobbing machine.

Time Saving Railroad Shop Methods

By Fred H. Colvin *

Some of the devices which have reduced shop costs in the various shops of the Canadian Pacific Railroad.

Methods for handling castings, finished parts and boiler flues; forming equalizer beams; quartering wheels; heating driver and truck tires.

*Managing editor.

There are many interesting devices in use at the Angus shops of the Canadian Pacific Railway, at Montreal, and several of these are shown herewith, to give an idea of the way in which some of the problems have been solved. These have helped to reduce the cost of repairing locomotives and have been devised by various members of the working organization.

Trucks for Handling Castings

Fig. 1 shows the style of trucks used at the Angus shops for handling castings and other materials in various parts of the plant. It will be noted that these are narrow-gage trucks and that the two inner rails are very close together, so as not to occupy too much space as they go up the center aisle of the shop itself. Although the view shows two of these cars outdoors, as can be seen from the office building at the left, the same track arrangement extends through the center of the main shop, with suitable turntables whenever it is necessary to run them off at right angles.

It will also be noted that the inner wheels of the two trucks are very close together and that the platforms do not extend over the wheels on the inside, being so made as to allow them to pass easily, the extra width being secured on the outside. They are also provided with a substantial ring at each corner so that the whole car can be easily picked up by a crane of any kind and placed in any desired position.

Trucks for Flues

Another method of handling material is shown in the trucks made for the locomotive flues as they come out of the engine to be repaired. These are shown in Fig. 2 at one side of the flue-welding department. As the flues are taken out of a locomotive boiler they are placed in one of these cradle-shaped trucks, a separate truck being used for each locomotive so that there will be no mixing or interchanging as they go through the shop for repairs. These cars are then run into the flue department, and in case of being crowded, as indicated in Fig. 2, they are picked up by the crane and piled one on top of the other, as can be seen. In the right-hand corner of the room is the flue rattler into which they are placed for cleaning before they are cut off and the new safe ends welded on. These machines are also at the right-hand side of the room and so arranged that the flues are cut off, the safe ends welded on and hammered down and all the work necessary done on the tubes without turning them end for end. As soon as finished they are again placed in the trucks and are ready to be replaced in the locomotive boiler where they belong.

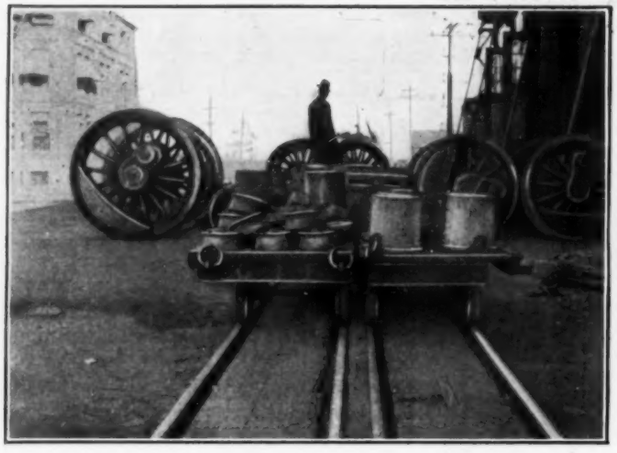


Fig. 1. Offset Trucks Passing Each Other

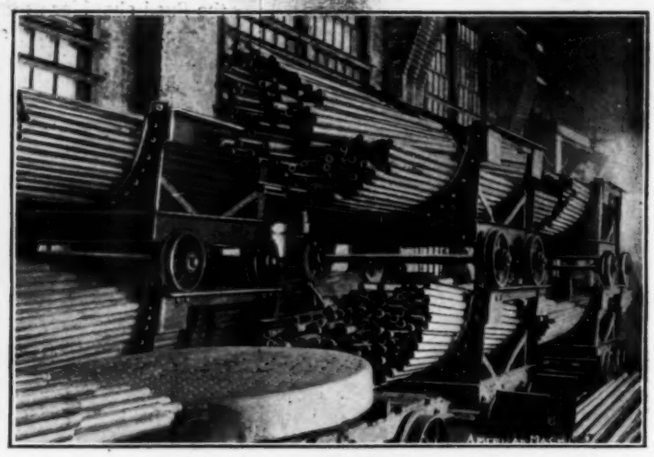


Fig. 2. Trucks for Boiler Flues

Forging Equalizer Beams

In the same department is the heavy hydraulic forging press shown in Fig. 3 for making equalizer beams. The furnace is at the right, the rails shown leading to it and allowing the easy handling of the heated equalizer beams, one being shown at *A*, just after being bent in the press. The slings *B B*, with the eye opening on the end in which the beam is hanging, allow the hot bar to be run in place before the dies are brought down on it and the bar is bent as can be seen at one operation. This means a large bend as can easily be seen by comparing sizes of the surrounding parts, the bar being supported against buckling by proper channels in the dies themselves.

Locating and Turning Crank Pins

Figs. 4 and 5 show an interesting machine and methods for testing the relative

FIG. 3. BENDING LARGE EQUALIZER BEAMS

location of crank pins as well as re-turning them after they have become worn out of round.

Fig. 4 shows the square used in determining when the crank pin or the hole bored for it, as the case may be, is level and consequently at right angles to the crank pin in the other wheel, which is at the lower center to be re-turned.

A center block *A* is placed in the crank-pin hole and the upper edge of the leveling device *B* is placed across the center of the axle and the center of the crank pin, and the position of the plumb-bob *C* noted. If this is not exactly correct, the wheels are turned slightly until the right adjustment is secured. In case there is a crank pin in this wheel, the V-shaped opening *D* is placed against the crank pin, while the edge *B* is across the center of the axle and the position is tested by the plumb-bob as before.

At the other end of the pair of wheels is the head for returning the crank pin. This is a very substantial head, with a long, hollow spindle, turning in the bearing shown. A groove planed in the center of the bearing cap locates the indicator *A*, the point of this fitting into the center of the axle.

Different indicators or gages are supplied for different crank distances between axle and crank-pin centers, so that the crank pin to be turned can be adjusted into exactly the right position to be returned. The axle is supported at each

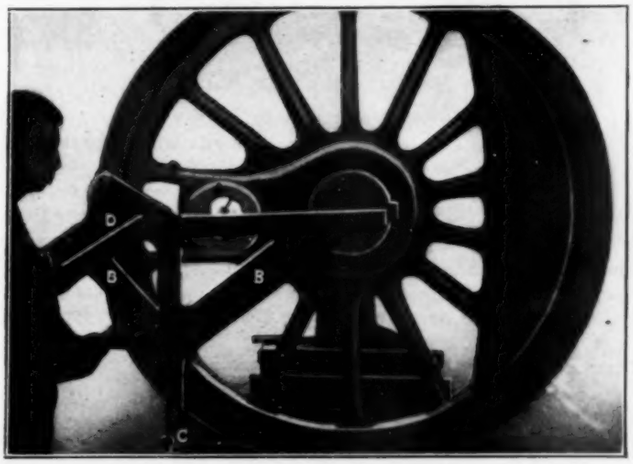


FIG. 4. SETTING CRANK-PIN HOLE AT QUARTERS WITH CRANK PIN

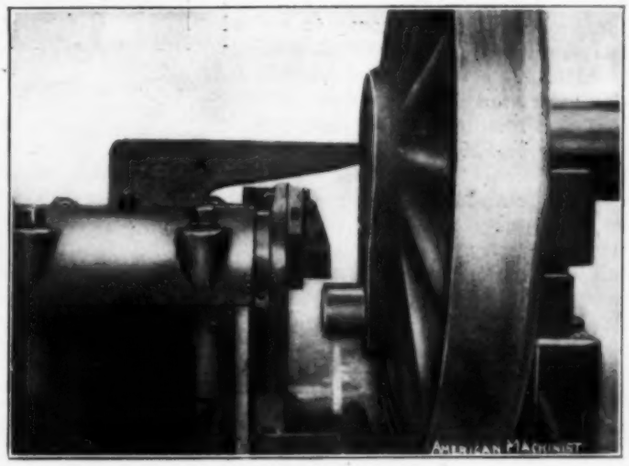


FIG. 5. RE-TURNING THE CRANK PIN

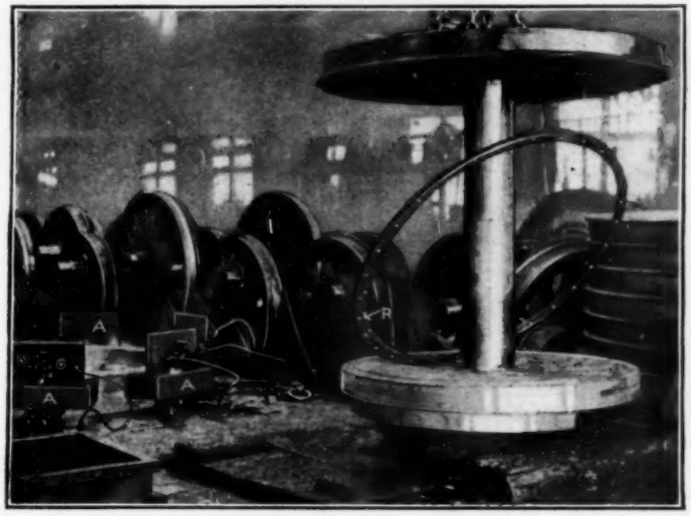


FIG. 6. HEATING DRIVER TIRES FOR SHRINKING

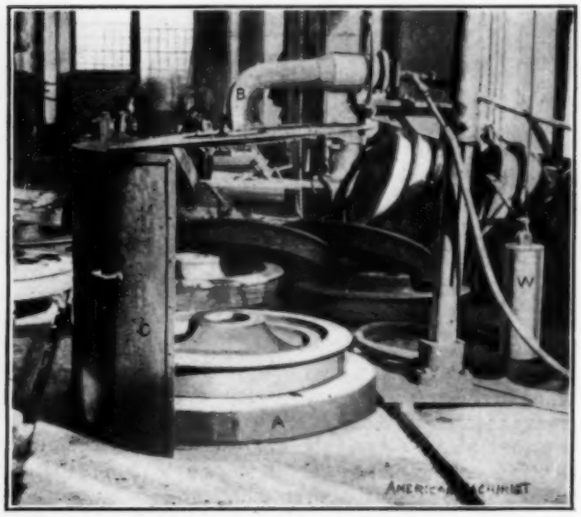


FIG. 7. HEATER FOR TRUCK TIRES

end inside the wheel, and adjusted vertically by jacks until the crank pin comes into the exact position so that the throw will be right when it is returned in this machine.

The end of the hollow spindle carries a very substantial tool head *B*, with as little overhang as possible, so that the cutting tool is rigidly supported and can produce a round pin instead of following the irregularities of the pin which has been worn. The pin shown in this case is very short, as it is not a main-wheel crank pin, but in any case there is very little overhang to the cutting tool. It is mounted in the large-diameter, hollow spindle *C*, is fed over the pin so that the crank pin goes inside the spindle, the whole thing being very rigid even on the longest crank pin.

Heating Driver and Truck Tires

Fig. 6 shows the method of heating tires for driving wheels by means of independent oil burners set around the tire, which is rested on blocks to raise it the proper hight from the floor. These burners are shown at *A A A*. When the tire has been heated enough to expand sufficiently, the mounted wheel center is lifted by the crane and lowered into the tire, being allowed to remain in this position until the tire cools off sufficiently to grip the wheel center. Then the retaining ring, which is shown in place around the axle, is fastened in place and the pair of wheels is ready to be put in place under the locomotive.

A different arrangement is used in the case of truck wheels, as can be seen in Fig. 7. Here, six wheel tires are piled one on top of the other on the cast-iron block *A*, and the burner *B* swung in place over them, as shown. Sheet-metal guards *C* are then placed around the tires to prevent the escape of heat, and it does not take long to heat the tires sufficiently for them to go over the wheel centers.

The wheel centers are placed on raising blocks around the heater, as can be seen, and as fast as a tire is heated sufficiently, the heater is swung out of the way, the upper tire lifted off by a convenient crane and lowered over one of the wheel centers. This is repeated until all of the tires have been heated, the last one being shown in place on the bottom of block *A*. The heating burner is supported on the column shown and can be swung around or raised and lowered as may be necessary, being controlled by the counter weight *W*.

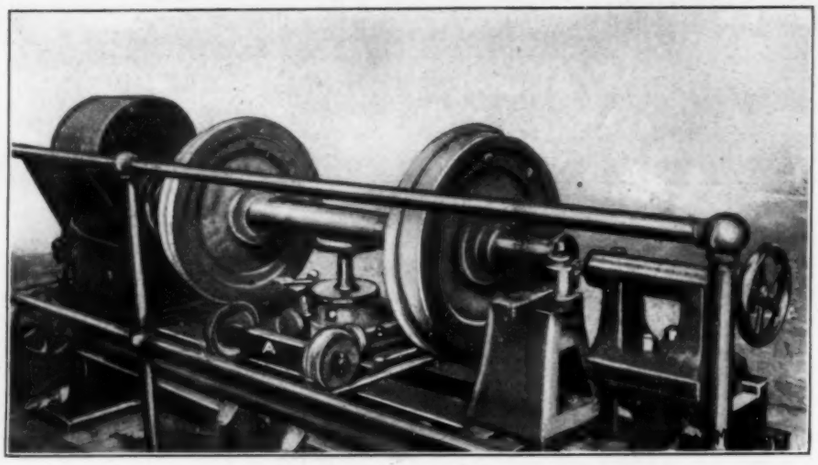


Fig. 8. Convenient Method of Handling Mounted Wheels and Axles

Re-turning Journals on Axles

A very convenient method of handling mounted wheels is shown in Fig. 8, which is a lathe equipped for the re-turning of journals on car axles. The lathe is located in the pit shown, so that the top of the bed is level with the floor of the shop. Mounted across this bed of the lathe and running back onto the floor of the shop is a pair of rails for the small four-wheel trucks *A*. On top of this and mounted on short rails running in the other direction is an auxiliary truck *B*, carrying an air cylinder *C* for handling the wheels. A pair of wheels is rolled or deposited by the crane in position back of the lathe, the air-hoist plunger lowered and the truck run back under the axle. Then the air pressure is admitted and the pair of wheels raised off the floor while the whole truck is rolled into position, as shown. The exact hight is easily secured by admitting or releasing air from the air cylinder, and the location of the axle on the centers of the lathe is controlled fore and aft by the auxiliary truck *B*, which allows end movement on the lathe. This makes exceptionally easy handling of what would otherwise be heavy work, and increases the output of both the man and the machine.

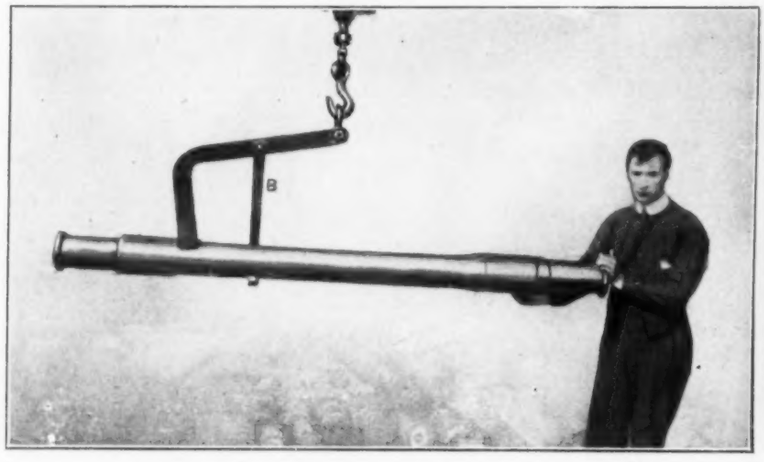


Fig. 9. Hoisting Axle Clamp

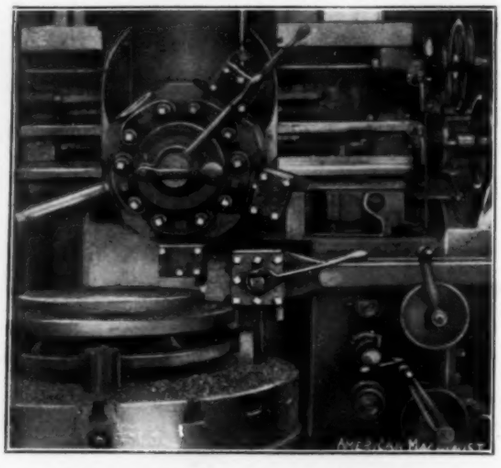


Fig. 10. White Background on a Vertical Lathe

A Convenient Hoisting Clamp

A rather unusual hoisting clamp, which can be easily operated by one man is shown in Fig. 9. This consists of the angle piece *A*, which has a forked end,

and the swinging hook *B* pivoted at its center and being hooked underneath the axle, as can be seen. At the outer end is the ring for receiving the drain hook, which, in this case, is attached to a direct air hoist. Although it does not look as though the axle would be balanced in this position, it makes a very rapid and convenient method of handling material of this kind.

White Backgrounds for Setting Tools

Although many who have attempted painting machine tools white have been laughed at for their pains, it has advantages of its own, as can be seen from Fig. 10. This is a Bullard vertical turret lathe, and it will be seen that the operator has painted the upright part of the frame behind the work and the tool heads white.

The paint is evidently the same mixture that he used in painting side rods, frames and similar parts when they came in for repairs, in order to detect any cracks which may have developed in service. In this case oil, which invariably works into such cracks, oozes out and shows itself very plainly on the white surface.

In the case of this machine it is used simply as a background, so that the operator can more easily see his work and the manner in which the tools are set.

There are doubtless many similar cases where a white background would be particularly useful and, instead of using a sheet of paper, as is often done, it might be well to follow this example and paint a permanent white background, which, if of enamel or of white paint properly varnished, would last for a long time and do more than might be imagined in aiding production.

Dividing Engine for Circular Scales

By W. R. Stamper

Design, construction, operation and test of an automatic dividing engine for circular scales, having an error in the worm wheel of less than 3.5 seconds of arc.

Having felt the need of a reliable circular engine, the department of physics of the University of California, some six years ago, decided to build such an instrument. As mechanician of the department of physics, it devolved upon me to design and build it. Being unable to get any helpful literature on the subject either from libraries or factories, I have decided to publish an account of its construction in detail, accompanied with drawings, so that those interested may perhaps derive some benefit from my experience.

The gear wheel *A* (see sectional drawing, Fig. 1) weighs 150 pounds and was made by the Brown & Sharpe Manufacturing Company, of Providence, R. I. It is of soft cast iron, suitably braced and designed. It is 24 inches in diameter, 1¼ inches thick at the teeth, with a taper hole in the hub. The hub is 4 inches long with a hole 2 inches in diameter at the small end, the taper being ½ inch per foot. The hole is not the running bearing, however, for the gear wheel is made rigid to the main spindle *D*, by means of the nut *B*, which is threaded on top of the spindle. On the top face of the gear near the edge there is a rough, coarse scale cut in the cast iron and divided into degrees for convenience in starting, rough dividing and calibration. There are 360 teeth in the gear wheel, thus dividing it into degrees.

The main spindle *D* is a piece of box-annealed machinery steel, and was well seasoned before the finishing was done. The spindle has a taper hole extending all the way through, which receives the taper spindle *J*, upon which all work to be divided is placed. This taper hole is 1¼ inches at the upper end and ¾ inch in diameter at the lower end, the taper being ⅝ inch per foot. The main bearing of the spindle has a taper of

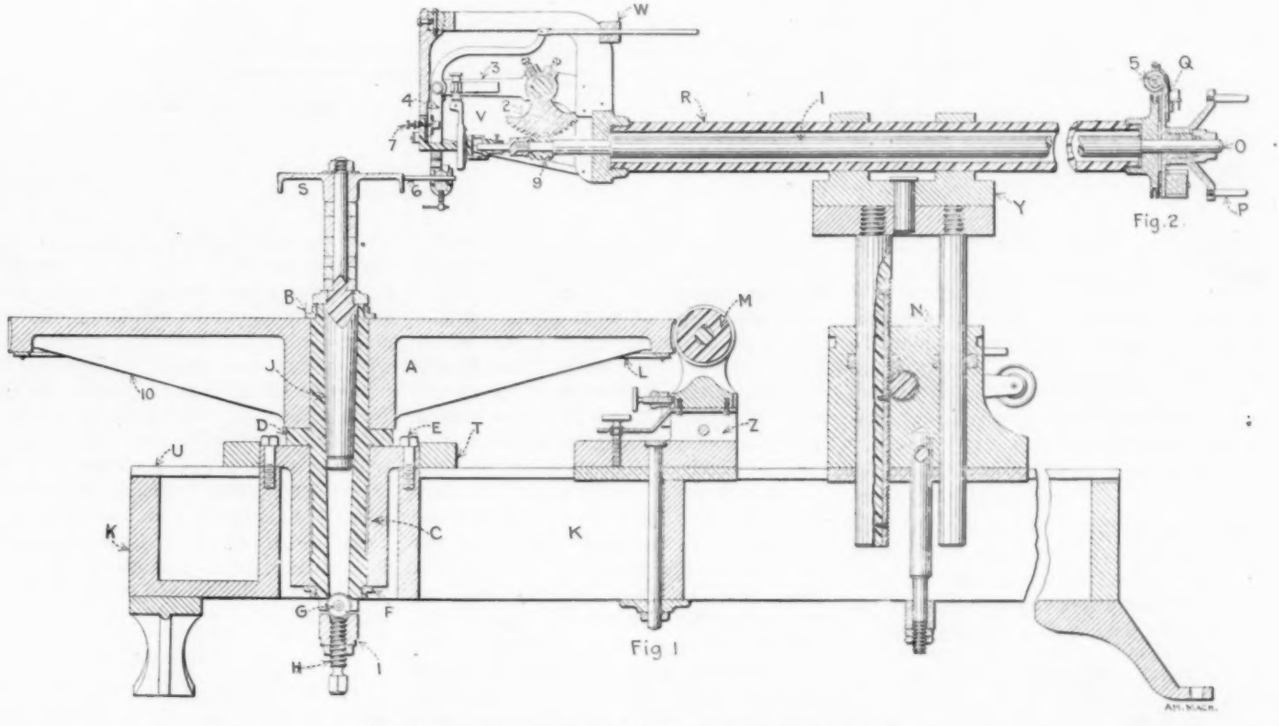


Fig. 1

Fig. 2

Section of Automatic Circular Dividing Engine

½ inch per foot, and is 5 inches long and 2½ inches in diameter at the large end. The spindle revolves in a cast-iron collar or bearing *C*, which was also treated so as not to change its form in the future. The flange of the collar or bearing *C* was scraped and carefully fitted on the bed *K* before the cap screws were screwed in place. I consider this bearing one of the most essential parts of the dividing engine and I was extremely careful to secure a good fit. The lapping of the taper hole was done with the aid of Arkansas stone dust. This dust, being readily dissolved in benzine, can be readily and thoroughly cleaned out when the work is done. I am using the best watch oil for lubrication, it being light and not gummy.

A critic may say that this bearing should be much longer. Perhaps so, but I doubt if it would be any improvement in accuracy, provided the short bearing is accurately made. However, if the scope of the machinery had permitted, I would have made the bearing somewhat longer but on the same general plan. To take the weight off the bearing I use the 1-inch, hardened-steel ball *G* instead of the double-ended male center employed by most factories. If there is any eccentricity in the rotation, the double-ended male center rod would have a tendency to raise the gear, while the steel ball would not. There is a hardened surface on the end of the adjusting screw *H*, on which the ball rests. I believe this is the better method.

Adjustment of the Bearing

The adjustment of the bearing is made, assuming that the bearing is in its working position free from dust and oiled with good watch oil, by applying a spring balance to the periphery of the gear wheel. I find that it takes a pull of from five to six pounds to start the wheel. I then screw up the screw *H* until about 149 of the 150 pounds are lifted, allowing a free running bearing with a film of oil about 0.0001 inch thick, which is sufficient for lubricating and retaining a good running bearing. I then find that it takes a pull of about 1½ to 2 pounds to start the gear wheel. After starting it took practically nothing to keep it going. However, in actual work the intervals during which the wheel is moving are so short that only the starting torque is important. Therefore, the weight must be taken off the taper bearing in order that there may not be too much strain on the worm in the driving gear, for much strain would mean inaccuracy. An added load of 145 pounds placed on the gear did not appreciably change the pull required to start the gear.

At first I applied what I called a balancing device, consisting of a cord which passed arround the sheave *L*, underneath the gear wheel, then to a pulley on the wall from which it passed over a second pulley on the ceiling, and carrying a weight nearly sufficient to supply the starting force of two pounds. It was found that this balancing device rendered the engine too sensitive to dust, and the unequal distribution of the oil on the gear made the readings vary from 10 to 15 seconds. The tangenial pull of two pounds, which must be supplied by the worm, seems to be of more advantage than reducing this pull by balancing, provided the friction head *O* on the shaft remains constant in its rotation.

The worm *M* was also made by the Brown & Sharpe Manufacturing Company to the same degree of accuracy as the gear. It is mounted on a suitable bearing or support *Z*. It has a thrust bearing, stops and all required adjustments. It is provided with a ratchet and automatic friction head, not shown in Fig. 1. In addition to the friction head on the driving shaft of the worm there is a second friction *Q*, Fig. 2, on the shaft controlling the cutting device. These friction heads have wooden surfaces set endwise of the grain and rubbing against cast iron. The greatest possible care was taken to obtain constant friction. The wood used was teak, which furnishes its own lubrication, as it is naturally oily. The wear is taken up by a spiral spring, as shown in the figure. The two friction heads are run from the same source, one friction head waiting while the other catches up and *vise versa*.

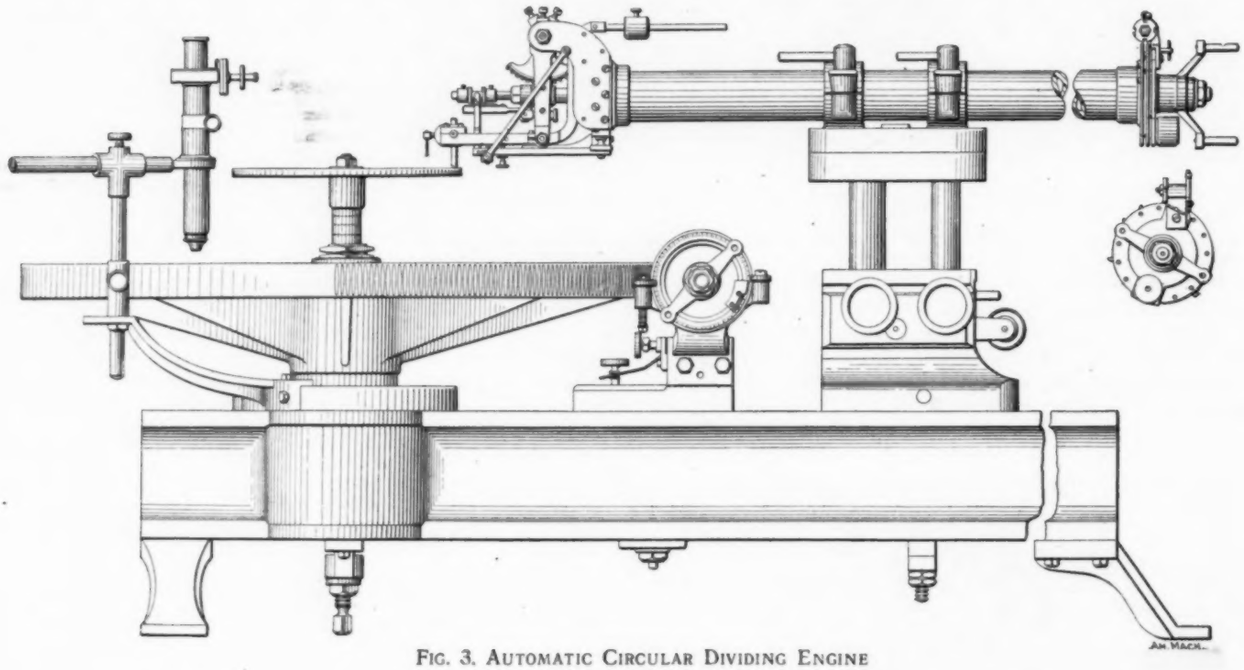


Fig. 3. Automatic Circular Dividing Engine

The tailstock *N*, Fig. 1, is movable either way along the bed *K* and is provided with tighteners similar to the ordinary lathe. The support *Y* is provided with a rack and pinion adjustment, by means of which it is adjustable up and down to suit the work. There are also tighteners provided to keep it in required position after it has been moved. The hollow steel shaft *R* passes through the support *Y* and is also provided with tighteners, so that by the adjustments of the tailstock it is possible to divide a circle of any size up to 5½ feet in diameter.

The Marking Head

The marking head *V*, which is rigidly attached to the end of the hollow shaft *F*, is operated by means of the shaft 1,

and by the rotation of the friction head, which also propels the part *Q*. The slotted disk, shown in Fig. 2 on the piece *Q*, strikes against the stops placed at the required distance apart. On the piece *P*, Fig. 2, there are three stops, as seen in Fig. 3, long, medium and short. When a long line is made, the piece *Q* will rotate and allow the deep slot in the slotted disk to pass over the two shorter stops and stop at the longer one. Part *Q* is then rotated back until the star or escapement wheel 5 strikes a hook or stop, shown in Fig. 2, which rotates disk 5 one tooth and also rotates the slotted disk, so that when *Q* is again rotated toward the stop it strikes a section of the slotted disk where there is no slot, and, therefore, makes a short line. This operation is continued, enabling one to produce graduations with any required lengths of lines.

The worm 9 is keyed to the shaft 1, so that when 1 is rotated it rotates the gear segment 2, moving the arm 3, lifting the part 4 and thereby causing the knife or cutter 6 either to cut or return upon the periphery of the wheel *S*. The counterpoise *W* is adjusted so as to make the line as fine as desired. The known thickness. I used silver-solder knife up and down.

The marking or cutting knife is provided with a micrometer attachment, having divisions of 0.001 inch, enabling the operator to set the knife properly. The first line is always the hardest to make.

The method of setting the knife is as follows: The scale to be cut is put on and centered to within 0.0001 inch. The cutting head is then lowered by lowering the headstock until the cutter is within about 1/32 of an inch of the scale surface. The operator then lowers the knife by means of the micrometer screw

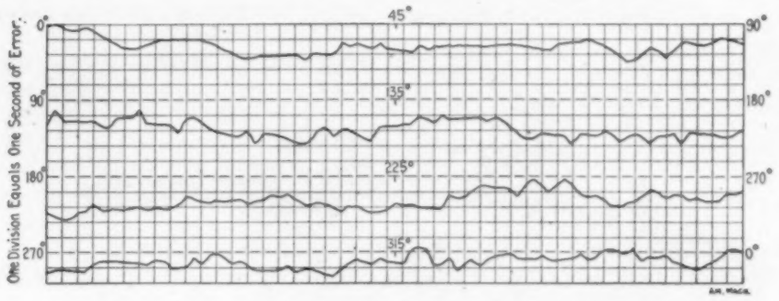


FIG. 5. CALIBRATION CURVE OF CIRCULAR DIVIDING ENGINE

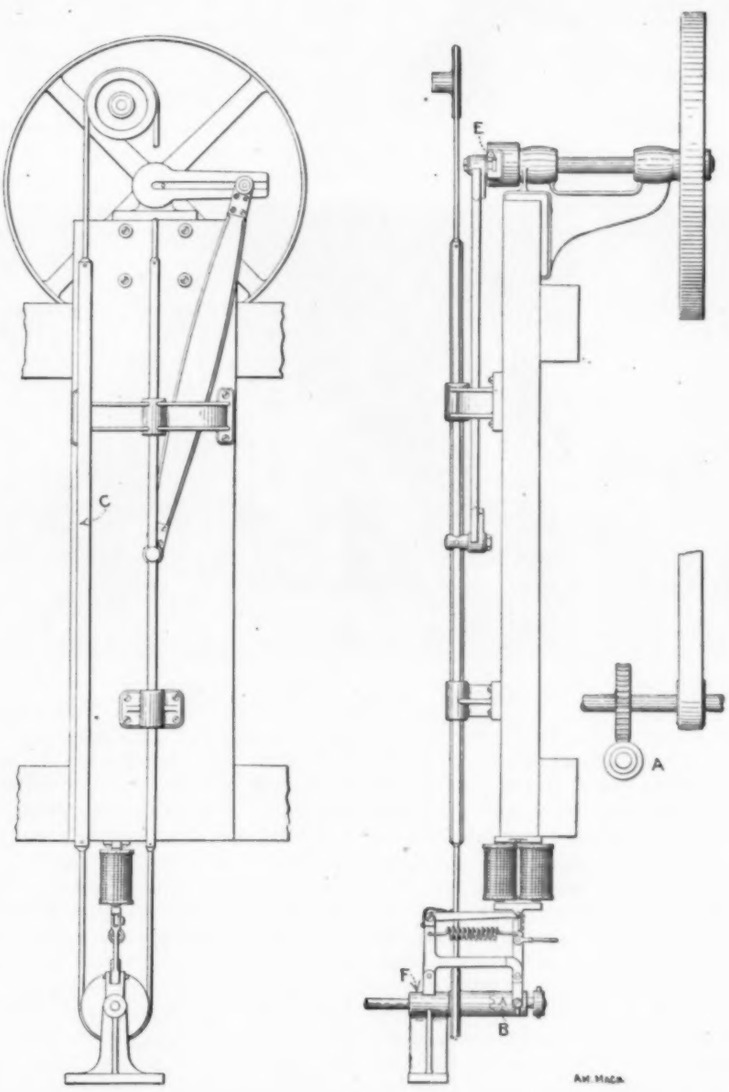


FIG. 4. DRIVING MECHANISM FOR CIRCULAR DIVIDING ENGINE

until it touches a test piece of silver, which is inserted above the scale under the knife point, the test piece being of known thickness. I used silver-solder foil 0.002 inch in thickness. The test piece is then removed and the knife lowered to the necessary depth allowing the proper drop after the knife leaves the scale. The scale is then ready to be cut.

The cutting head *V* is provided with cams, screws, lifts and all necessary adjustments, as may be seen from the several figures. In Fig. 1 the head is set to divide the periphery of the wheel *S*. In Fig. 4 it is set to divide the top surface near the edge, as an ordinary spectrometer scale is divided. It can be seen from the drawings that there are only a few parts to be interchanged in shifting from the top surface to the periphery, or the reverse. The head may seem complicated but a study of the drawings will show that it is extremely simple.

AUTOMATIC DRIVING DEVICE

The engine is driven by a ½-horsepower, 104-volt, self-starting, alternating-current Wagner motor, making 1800 revolutions per minute. Owing to the fact that we were unable to get a slow-running, self-starting, alternating-current motor, it was necessary to gear down so that a motor speed of 1800 revolutions per minute would make one line in about two seconds.

The automatic device is propelled by the motor through the steel worm and gear *A* and *B*, Fig. 3, by a belt to crosshead *E*, then transmitting motion by an endless belt to the loose-wheel clutch *F* on the main driving shaft, which produces a reciprocating motion which is adjustable at the crosshead *E* to any desired length of stroke. This enables the

stops on the engine to touch or dwell at each end of the stroke. It can be so adjusted that the stops will strike a little before the end of the stroke, thus allowing the frictions to slip, and thereby giving always the same pressure at the end of each stroke. At *C* is a steel shaft which forms a part of the endless belt acting as a counterpoise.

The toothed clutch *H* is fixed on the main shaft by means of a feather, allowing it to slide and engage or disengage the clutch *F*, on starting or stopping the dividing engine. In the figure the engine is supposed to be running.

Wishing to start the drive the operator throws in the main switch (not shown). This is a double switch, which closes the battery circuit and at the same time starts the motor which has a direct connection with the driving device. The clutch *F* is now open, the commutator being held against the electro-magnets. To start the engine one need only engage the clutch at the proper time. The engine is now running and needs no farther attention until the completion of the scale to be cut.

In the automatic stopping of the engine the counter plays an important part. Every time a line is made the counter registers one, thus enabling the operator to know just how many lines has been cut and how many more remain. To set the engine to stop automatically after the last line has been made, the counter is set by subtracting the number of lines to be cut from the limit of the counter, the limit being 10,000. That is, if it is desired to cut 360 lines the counter would be set at 9640. When the limit of the counter is reached the circuit containing the electromagnets is closed. This excites the electromagnets, which in turn pull up the armature, thereby releasing the clutch and stopping the engine. The opening of the clutch causes the main switch also to open, thereby breaking all electrical connections, both battery and power, and avoiding all danger of fire. The intention is to cut the scale during the absence of the operator. Upon the stopping of the engine a bell in the shop rings, thus notifying the operator of the completion of the scale.

The Brown & Sharpe Manufacturing Company deserve credit for their interest in and workmanship on the worm and gear of the machine. They stated in a letter to the department of physics that they could cut a gear that would be accurate within five seconds of arc and it would appear from the several calibrations described below that their statement has been more than fulfilled.

Figs. 6, 7 and 8 show the completed machine.

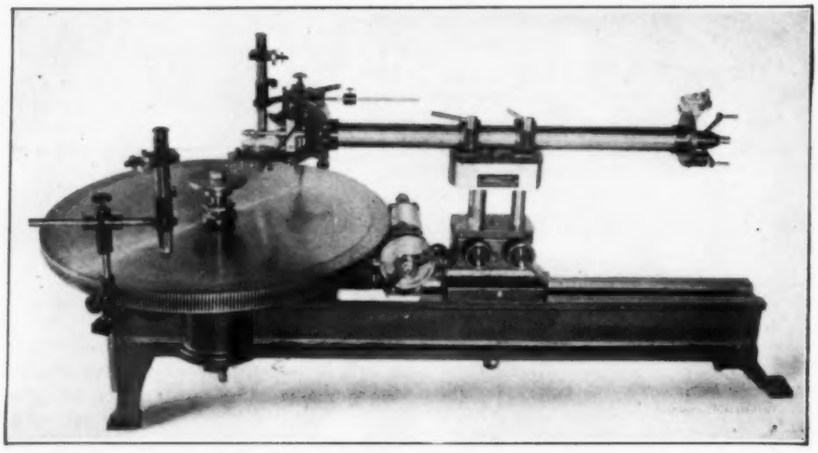


FIG. 6. THE CIRCULAR DIVIDING ENGINE COMPLETE

CALIBRATION OF THE ENGINE

After the completion of the engine and a few circles had been divided it seemed desirable to calibrate the instrument, not merely to ascertain the error of graduation but more especially as an aid in reducing those errors to a minimum by further lapping of gear and worm. The details of calibration were carried out by T. A. Davidson, then an assistant in the department, with my aid.

The calibration was made in the early part of 1910, the error then being 8.5 seconds. Since then I have lapped the worm and gear and the error has been reduced to 3.5 seconds. It could undoubtedly be reduced still farther but time for such a task is lacking.

The method used was an optical one; a mirror was mounted on the axis of the main gear wheel in which the image of a fixed scale was observed through a fixed telescope. The scale was strongly illuminated and placed about 20 meters (70 feet) from the dividing engine. The telescope system, placed close to the engine, consisted of an Edelmann telescope with an objective of 50 centimeters (20 inches) focal length, the eye-piece of the telescope being replaced by a compound microscope. This arrangement gave clear definition, and good magnification, enabling the scale to be read to 0.1 millimeter, (0.004 inch) and the aberration errors were negligible. The mirror was of speculum metal, finished by Brashear,

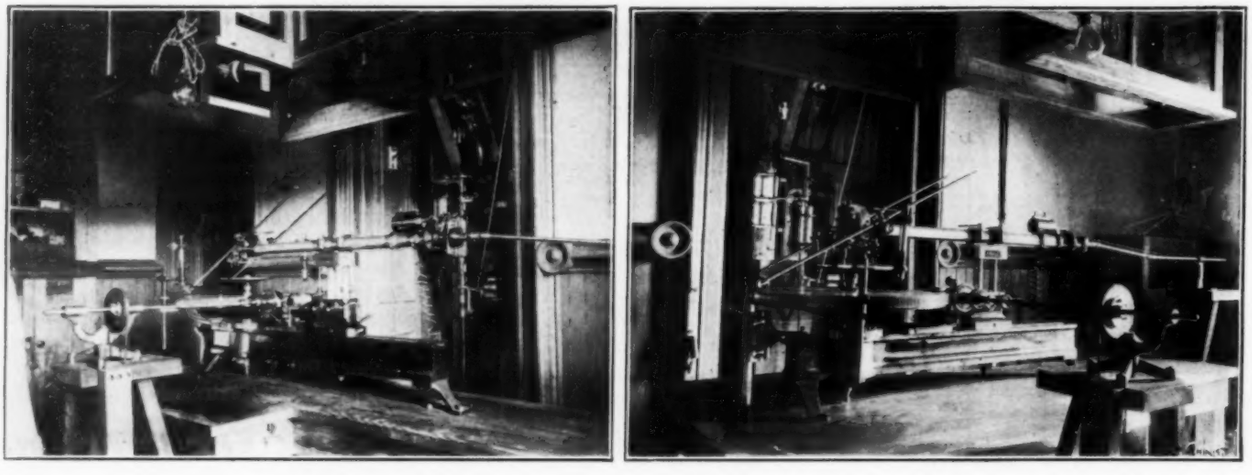


FIG. 7 TWO VIEWS OF THE CIRCULAR DIVIDING ENGINE AS COMPLETELY INSTALLED FIG. 8

and mounted in a wooden clamp which fitted into a brass collar attached to the center of the gear wheel. The mirror could thus be rotated around the center but would remain in the same position relative to the gear wheel during the taking of a reading. A small rod inserted horizontally in the clamp could be operated by means of a lever provided with stops, thus enabling the observer to rotate the mirror back to the zero position without leaving his station at the telescope. The lever was arranged so as to move out of the way during the taking of a reading.

Peculiarities Learned by Experience

During the preliminary work several minor defects and peculiarities were noted and their disturbing effects in a large part remedied. For example the gear wheel was found to be slightly eccentric. The introduction of a strip of platinum foil on one side between the shaft and the gear wheel caused a shifting of about one four-thousandth of an inch and almost completely remedied the defect. At first about 80 per cent. of the external force moment necessary to start the gear wheel was supplied by an external weight system, the balance of the force being supplied by the worm. Consistent readings could not be obtained owing to the unequal thickness of the oil film on the different parts of the gear and on the same part for succeeding revolutions. After a fresh application of oil successive readings might differ by as much as 15 seconds. Minute particles of dust floating in the air and lodging on the gear or worm also caused variations of about the same magnitude. The suspended weight system was removed, allowing the worm to supply the entire force moment necessary to start the gear, and it was found that the force required was sufficient to reduce the film of oil between the bearing parts of the worm and gear to a uniform thickness as was evidenced by the fact the constant readings obtained. The oil used on the gear was "three in one"; after a fresh application of oil the gear was turned by the worm for several revolutions to obtain as uniform a distribution of the oil as possible. In actual work the engine with the circle which is being cut is protected by a glass case, thus reducing dangers from dust to a minimum. It was found moreover that the dust seemed to squeeze out from between the bearing surfaces with the oil, thus giving little trouble.

Minute particles of lint floating in the air are more troublesome since they neither crush nor squeeze out with the oil. The tangential push exerted by the worm in starting the gear is about two pounds. Changes in temperature due to the presence of the operator and small changes in temperature which occur from day to day produce only a negligible effect.

Method of Calibration

In the preparation of the calibration curve shown in Fig. 5 the initial readings were taken with two telescope systems, similar to the one described, placed 90 degrees apart. First the reading of the scale was taken in one telescope. Then the gear and mirror were rotated through 45 degrees and the second reading taken in the second telescope. This was repeated several times around the circle, the average reading for each point being taken. It was by means of eight points thus determined that the eccentric of the gear was located and corrected. One telescope was now moved to a position 30 degrees from the other telescope, which remained fixed throughout the entire calibration, and the two 15-degree points between each of the 45-degree points were located. The second telescope was again moved to a position 10 degrees from the fixed telescope and the 5-degree points carefully located. The 1-degree points were then located, using only one telescope.

In the curve of Fig. 5 absissas denote degrees corresponding to the divisions on the top face of the gear and the ordinates the given errors in seconds of arc. The maximum error is seen to be about 3.5 seconds of arc. In graduating a circle fractions of a degree are obtained by means of a ratchet wheel. Formerly a periodic error due to the faults in the ratchet was introduced, but at the present time practically all such error has been eliminated by proper correction of the ratchets.

Readings for the ⅙ degree and the 1 degree were also made when the machine was running automatically. The readings differ slightly from those made by hand, on the whole being more constant. This arises from the fact that with the hand turning, the force which the wheel strikes the stop varies somewhat, while with the automatic turning the friction heads maintain uniform action.

When furnishing the worm and gear the Brown & Sharpe Manufacturing Company advised that the lapping be continued for at least three days using an abrasive material which they supplied. They assured me that if this were done the error would not exceed five seconds of arc. Not all lapping has yet been done. Before the last calibration I laid off a calibration curve to proper scale on the face of the gear wheel, then during the process of lapping I increased the friction at the divisions denoted by the high places on the curve, the worm being run by a motor. Arkansas stone dust was used as the abrasive material for this lapping. By this system the error could undoubtedly be reduced to 1 second of arc.

Metal Pattern and Core Box for Valve Bodies

By T. B. Gray

The illustration shows a metal pattern and core box for a valve body. The two halves of the core box are of cast iron. The halves were faced and doweled together, then bored on an angle plate in correct relation to the core, which was just cleaned and smoothed.

A wide keyway was cut so that the core when made could be brought in

Metal Pattern and Core Box

proper alinement with the pattern. The pattern is provided with a key that has draft on all sides and makes a recess fitting the key on the core. A brass plug was turned, fitting the small bore of the core box and filed to the proper shape after being keyed to one-half of the box, so as to secure the proper position every time. The plug is drawn out from the end and the box is pulled apart when removing the core for drying. The metal pattern, which seems very long in comparison with the finished valve body on the left, has a chucking allowance of half an inch on the end. A finished core is seen in the picture. The metal core box was a great improvement on the wooden one.

Automobiles and parts thereof exported from the United States during 1911 will aggregate approximately $20,000,000 in value. Figures of the Bureau of Statistics, Department of Commerce and Labor, show already for the seven months of the year for which export statistics are available, over $9,000,000 worth of automobiles exported, $2,000,000 worth of parts thereof other than tires, and $1,500,000 worth of tires, making the aggregate for the seven months $12,500,000. Should the exports continue at the same rate during the five remaining months of the year, the total would cross the $20,000,000 line. Even this does not include the automobiles sent to Porto Rico, Hawaii and Alaska, which with the parts thereof aggregated over $1,500,000 value during the last fiscal year.

Continuous Reading Grinder Caliper

By Henry K. Spencer*

A device attached to the vertical surface grinder for showing at all times the exact amount of material which must be removed from the work to bring it to size. The construction permits readings to be taken continuously or at any time during the operation without stopping the work of grinding.

Details of the instrument with applications to various classes of work.

*Mechanical engineer, Blanchard Machine Company.

The increased driving power and weight of the modern machine tool has made possible a large reduction in the time required for removing stock from the work, and naturally the other quantities involved in the total time per piece have relatively increased. The smaller the time for removing the stock becomes, the greater, relatively, is the time required for measuring and for handling the work.

The Blanchard Machine Company, Cambridge, Mass., in developing its high-power vertical surface grinder, soon found that in many cases the time for removing stock was by far the smallest quantity included in the total time per piece. Magnetic chucking considerably reduced the handling time, but the need for a quick way of measuring the work thickness was imperative if the maximum economy was to be attained.

The Object of the Device

The continuous-reading caliper has been developed to meet this need and has proved so successful that all Blanchard grinders are arranged to use this device as an attachment. Briefly, it may be described as a device which measures the work thickness continuously during the grinding operation, showing the operator by means of a dial the exact amount in thousandths of an inch by which the work exceeds finished size. The caliper is attached to the carriage of the grinder in such a position that the rotary work table carries the pieces which are being ground, alternately under the wheel and under the caliper, so that each piece is measured after every pass under the wheel.

In Fig. 1 the caliper is seen in the foreground with its contact point resting on one of the steel blocks which are placed around the rotary work table in position for grinding. The 16-inch cylinder wheel of the grinder, surrounded by a steel safety hood, is seen at the rear of the table. Fig. 2, which shows the parts in plan, will make clear their relative positions. When removing or placing work the table is moved out from under the wheel to the position shown in dotted lines, and the caliper, which moves with it, swings to one side, as shown, leaving the table entirely clear.

Construction Details

The contact point on the caliper is seen in Fig. 3. The hardened steel button which rests on the surface of the work connects by a light push rod inside the vertical tube, with the Ames gage head seen in Fig. 1, at the top of the tube. Referring again to Fig. 3, the tube slides in a split sleeve, which may be clamped to it by the large nurled nut, seen just above the arm, and this sleeve in turn has a limited motion vertically, through the arm, controlled by a rack and pinion operated by the nurled wheel. This last motion is clamped by the small screw with ball handle, seen at the extreme left in Fig. 3. These movements are simply for convenience in quickly setting the contact point after an approximate adjustment is made by sliding the arm up or down on the column.

Setting the Gage

Fig. 4 shows the dial-gage head used, which is graduated in thousandths of an inch. The dial can be revolved to set the zero graduation as required.

To set the caliper for size a finished piece known to be correct in thickness is placed on the table. After setting the arm about 2 or 3 inches above the surface of this piece, the tube is moved down, bringing the button in contact with the piece and giving an indication on the gage. All adjustments are then clamped and the dial of the gage revolved until the zero mark coincides with the pointer. With the caliper set in this way, it will indicate zero when the work is ground to size, and if the work is oversize, the readings will show the excess stock in thousandths of an inch.

Readings are taken by the operator without interrupting the grinding. The caliper is simply swung over the work while the latter is revolving, and the dial shows at a glance how much more stock to remove. The caliper may be brought

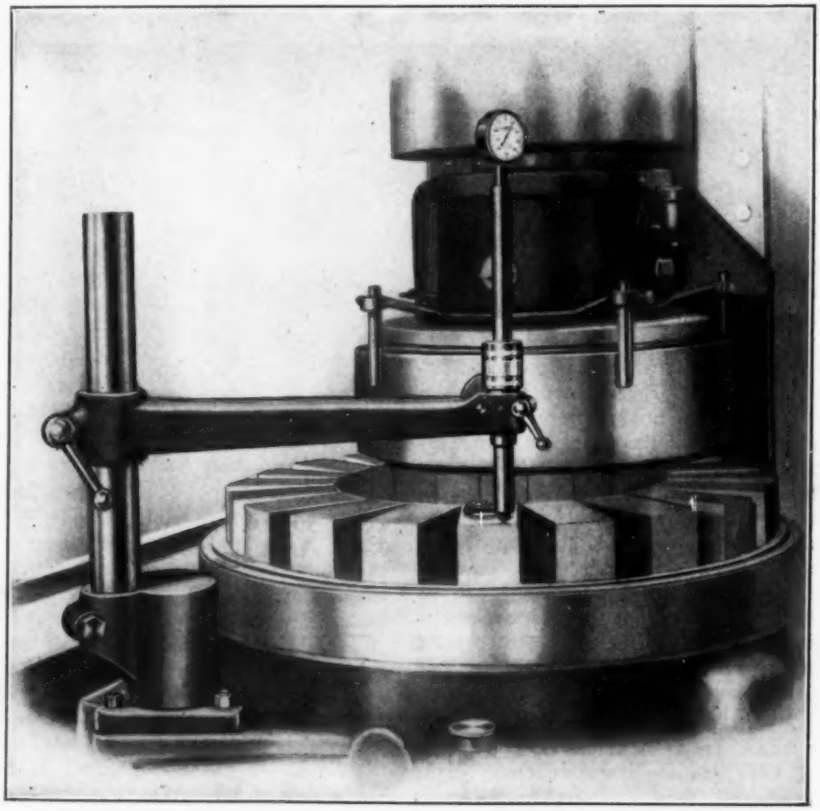


Fig. 1. Continuous-reading Caliper on Blanchard High-power Vertical Surface Grinder

into action as soon as the grinding begins and left there, giving a continuous indication, which approaches zero as the stock is removed; but this is not necessary, and considerable wear on the contact button can be saved by using the caliper only at intervals, until close to size. The wear of the button becomes appreciable only after several lots of pieces have been ground, and is readily compensated for by checking a piece in every fourth or fifth lot with micrometers, and setting the dial ahead an amount equal to the variation found. This applies to work where the limits are ± 0.001. For closer limits checking must be more frequent. The contact button can be easily replaced when worn.

The Adjustable Joint

A unique feature of the device is the adjustable joint between the fixed pivot in its base and the carriage of the grinder. A triangular flange is seated on a steel ball at its center and held down by three studs at the corners, so that by adjusting the nuts on these studs the axis of the pivot can be tipped in any direction. This is used to set the pivot perpendicular to the work table, so that as the caliper swings, the contact button moves exactly parallel to the table. The indication of thickness will, therefore, be the same, on a block of uniform thickness, at all points of its swing.

The pivot joint is cylindrical, ground and lapped to a close fit, and is entirely closed against the entrance of moisture or dirt. The vertical load is carried by a flat surface of hardened steel bearing on a hardened-steel ball placed centrally in the top of the pivot.

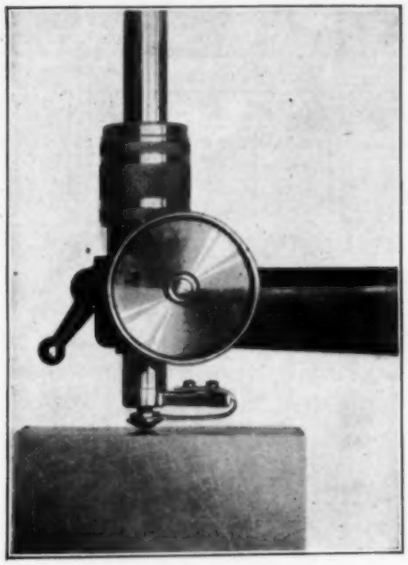


Fig. 3. The Contact Point of the Caliper

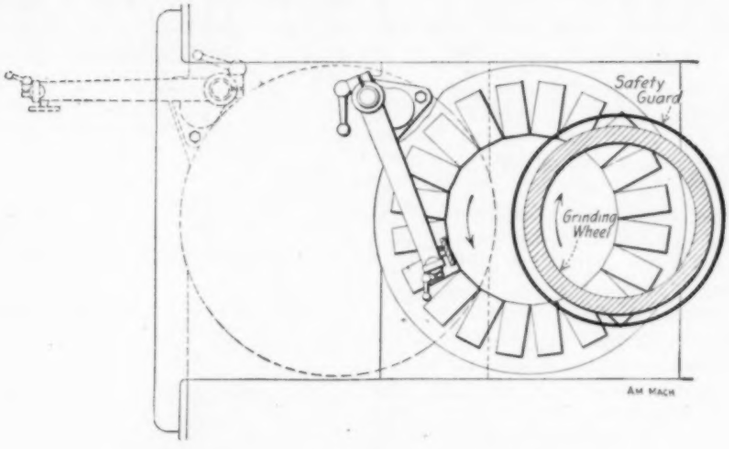


Fig. 2. Diagram of Continuous-reading Caliper

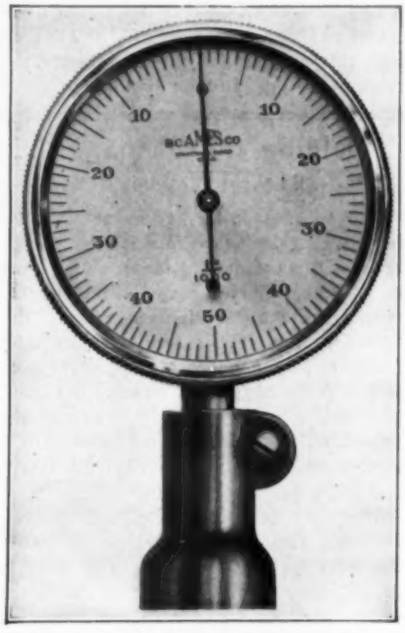


Fig. 4. Gage Head for Continuous Caliper

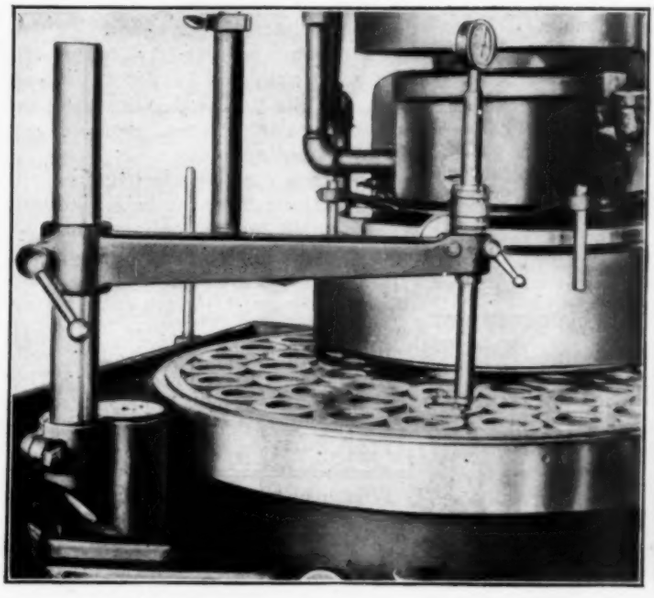


Fig. 5. The Caliper in Use on Cast-iron Washers

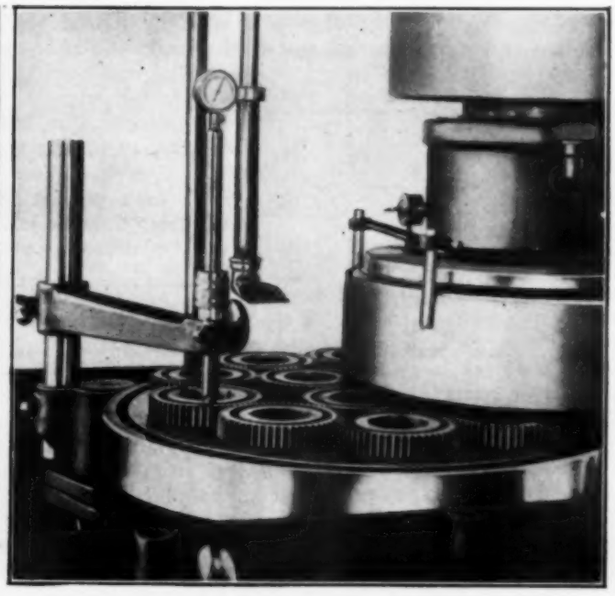


Fig. 6. Caliper As Used When Grinding Gears

The tubular steel column may be unclamped from the base when the caliper is not in use, and since the pivot is in no way disturbed, the alinement will be correct when the caliper is replaced.

Fig. 5 shows the caliper in use on cast-iron washers, and Fig. 6 on gears. In this latter case, where the ground surfaces are very narrow, it is sometimes necessary to slow down the work table when measuring. With the all-geared table used on the machine this is easily done, and the whole operation of reducing the work speed, measuring and returning to normal speed occupies less than 10 seconds, during which time the grinding operation is not stopped, but goes on at a somewhat slower rate.

Experience shows that the average operator can work to limits of ± 0.001 inch with this caliper and that it reduces the measuring time practically to zero.

A Bulging and Piercing Die

By Aron Lawrence

The accompanying figures show a die for drawing an oval-shaped bulge in the body of an automobile lamp, and, at the same time, piercing out a rectangular opening in the bulge to permit the mounting lug of the lamp to protrude. These openings come on opposite sides of the lamp body. Of course, the body must not be marred in drawing the bulges. The die is built on the end of a steel horn, and is used in a Bliss & Horning press.

The lamp body is blanked and pierced, an oval hole being provided to locate the work on the horn die. The body is rolled, edged and assembled with the back and taper on flare of the lamp, before the bulging is done, as this prevents distorting the body.

The general shape of the bulge and opening is shown by Fig. 1, and the die construction by Fig. 2. In Fig. 2, *A* is a soft-steel horn, machined across the

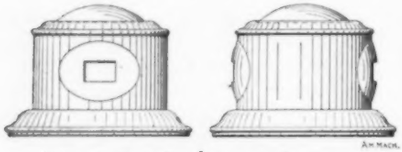


Fig. 1. The Bulge and Opening

upper, outer end. The hardened tool-steel die block *B* is screwed to the center of the horn as shown. A second, hardened tool-steel block *D* surrounds *B*. The upper parts of these two blocks form the bulging punch. A holding shoe *C*, of machine steel, slides around *D*, and is pressed upward by eight helical springs *H*, through the pressure buttons *G*. Four shoulder screws *J* limit the travel of the shoe *C*.

A combined locating and ejector block *E* is fitted to slide in the recess of *B*, and is actuated by the helical spring *F*

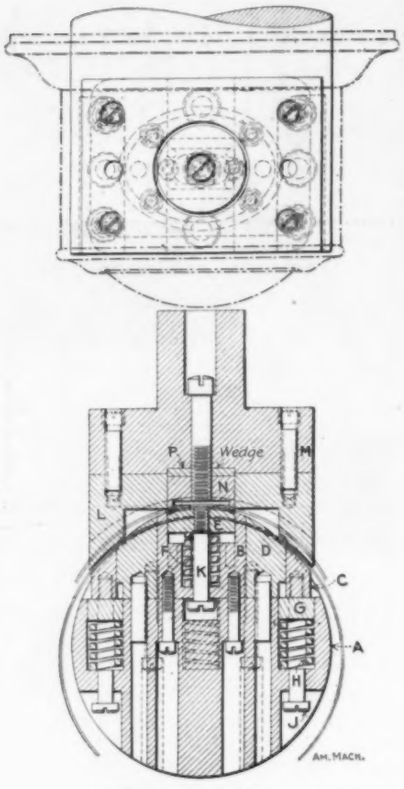


Fig. 2. The Die

surrounding the shoulder screw *K*, which prevents the block *E* from jumping out.

To the lower surface of the cast-iron punch holder *M* is fastened the bulging die *L* of hardened tool steel. A rectangular piercing punch of hardened tool steel *N* is screwed to the center of *M*. A three-degree wedge *P* regulates the punch entrance into *B*.

It is essential that the punch enter just far enough to pierce clean, allowing approximately the last 1/32 inch of the stroke, in order that the bulge may be fully formed before piercing; this prevents stretching the hole after piercing. The oval opening by which the body is located over the prongs of *E* stretches during bulging, but at this time the metal is securely clamped between *L* and *C*.

The small piece left on *E* is picked off with a pointed lifter, and is the only scrap from the job. The entire die enters the lamp body while operating.

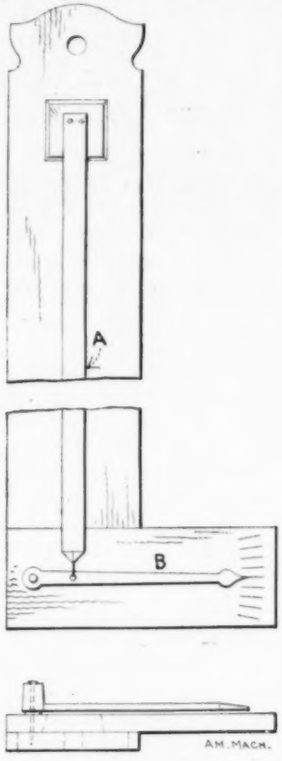
A Tracing Cloth Hygrometer

By Lynne Paschall

Anyone who has had experience with tracing cloth knows how sensitive it is to atmospheric changes. Often we have stretched the cloth as tightly as possible in the evening, only to find it in "hills and hollows" the next morning. An expansion of 1/16 inch to the foot is quite common. On the other hand, I have known cloth stretched down in moist weather to contract as the weather became drier, until it was torn, or a thumb tack pulled out.

Taking advantage of this property of tracing cloth, a very simple hygrometer or moisture gage can be made. This gage is not only an interesting novelty, but may be useful about the house to tell you whether the humidity of the air is right for your ferns and roses. It also makes a good "guessometer" for the amateur weather prophet.

The figure is almost self-explanatory. The instrument consists merely of a strip



A Tracing Cloth Hygrometer

of tracing cloth *A* attached to a freely moving pointer *B*, and both suitably mounted on a wooden base. The strip of tracing cloth may be about 30 inches long and the pointer 5, with the point where the cloth attaches about ½ inch from the fulcrum.

If there is a high-grade hygrometer at hand, the instrument can be graduated to read with it, but for ordinary purposes all we care for is relative humidity. Hence, one can graduate the scale to suit himself. Spaces 1/16 inch apart do very well.

I have a gage like this one in my workshop and find it very sensitive. When the floor is sprinkled preparatory to sweeping, the pointer often drops ½ inch or more.

The imports of machinery into South Africa for 1910 are estimated at $17,500,000, as against less than $10,000,000 in 1909. Mining and electrical machinery for the Rand constitute the greater portion of these imports.

Adulterations in Shop Supplies

By E. F. Davis*

Many common shop supplies and materials are adulterated, misbranded and subject to fraudulent substitution. Among these are oils, paints, shellac, case-hardening compounds, greases, cyanide, solders, etc.

In addition there are quack substances or nostrums offered for some manufacturing purposes.

A few tests are given that may be used to detect some of the common adulterants.

*Chemist, Warner Gear Company.

The work accomplished in recent years by the Department of Agriculture, as well as the researches of the various State laboratories in regard to foods and food products, has demonstrated the extent to which the fraudulent processes of substitution and adulteration have been carried on by the concerns manufacturing or supplying food-stuffs to the market. But now although in the matter of edibles we have the protection of the pure-food laws, in other branches of industry this fraud is still rampant. In manufacturing it is necessary to maintain supplies of oils and greases for machinery, raw materials, fluxes, chemicals, paints, varnishes, shellac and many other articles for conducting a factory. Keen competition and the general ignorance of purchasers of the "gentle art of doping" has made adulteration a common practice among unscrupulous dealers.

Another form of this "industrial piracy," if it may be so termed, has been the sale of compounds of unknown composition or "nostrums" for various purposes in the trades. The fact that many engaged in this "faking for profit" have waxed rich is sufficient evidence that a ready sale has been found to the unwary. Experience with these "nostrums" has taught many but it has in some cases been at the expense of financial loss and prestige.

There is scarcely a business but has these frauds to contend with. Take for example the glass manufacturer. He may find his powdered blue to contain mere traces of cobalt instead of two or three per cent. or it may be only sand colored with ultramarine. His lime may be rich in magnesia and his arsenic doped with chalk. To cover this entire field of investigation would, therefore, be an endless task, nor is this attempted; but believing that some data on these "nostrums" and general supplies would be valuable information to the many who purchase or use them, the compositions of some of secret compounds and adulterations of others, together with simple tests for the ascertaining of purity, are given in the following paragraphs.

Shellac

The common adulterant of shellac is colophony, or as it is commonly called, rosin. This is melted with the lac and is very difficult to detect by appearances as the physical and chemical properties of both are very similar, being both resins of about the same color and solvent in the same agents. Because shellac is of a darker color than ordinary is no proof of contamination with rosin as this color is mostly due to lac-dye, a red coloring matter from the insect whose sting on the tree causes the exuding of the resin.

There are several methods for testing the presence of rosin in shellac but a simple one can be performed as follows. Fill a small test tube one-fourth full of dimethyl-sulphate and drop in a small piece of the suspected article and apply heat. If rosin is present a coloration will be seen to take place in the tube: First becoming violet, then brown, then deep crimson and finally brown again. If the shellac is free from this adulteration no change will be observed except perhaps a slight turbidity. In order to become familiar with these changes in color a small piece of rosin may be substituted instead of shellac and the results of this test will be very apparent. Rosin-adulterated shellac used on patterns is the cause of considerable trouble in the foundry due to the sand in the molds adhering to them.

Potassium Cyanide

This valuable but exceedingly poisonous salt finds many applications in the various industries, being used in plating, as a flux, in metallurgy, and as a surface hardener for steel. The natural impurities in the compound are potassium carbonate and potassium cyanate. It is furnished to the trade in all percentages from 30 to 99 per cent. The active element in this is "cyanogen," upon which the value of the cyanide depends and while the percentage of this cyanogen may, when calculated as potassium cyanide, be according to the label on the containers, it is no proof that it has not been adulterated. Sodium cyanide is the chief agent used in "doping" this compound, it being a lighter and cheaper salt than the other and contains when pure about 53 per cent. of cyanogen, while the potassium compound contains only about 40 per cent. The difficulty of detection and the expense of conducting an analysis makes this a common method of adulteration.

Turpentine

This oil is mostly adulterated with mineral oils but wood turpentine and rosin spirits are also occasionally used for this purpose. A simple test for the purity of turpentine and the presence of foreign oils is to drop a small amount on a piece of white paper. If it contains other oils than turpentine a greasy stain will be left on the paper after the oil has evaporated; while on the other hand, if it is pure, no trace will remain.

Case-hardening Compounds

Case-hardeners have had their experiences with these "nostrums," of which there are a large number on the market, some of which are sold for prices far above the cost of which their ingredients warrant. These compounds have found a ready sale, especially to the automobile industry, where a large bulk of carbonizing is done. The following is the composition of several of these mixtures.

1. Coke and lime. One concern puts this nostrum out under several different trade names but which are different only in the degree of fineness they are ground. Analysis of this showed it to contain over 98 per cent. of coke, ¾ of a per cent. of sulphur and the remainder to be lime. This mixture could easily be made for less than $10 per ton but the presence of sulphur would be a serious objection to many. One grade of this "nostrum" sold for $60 per ton, f.o.b.

2. Oil and ground bone. This consisted of finely ground bone mixed with heavy oil residue and being of considerable weight was not an economical proposition considering the results obtained. It was ⅓ heavier than bone itself and the oil burned from the mixture before the absorption of carbon took place in the furnace (1500 degrees Fahrenheit).

3. Cottonseed hulls, potassium nitrate and ground bone. Placed in a carbonizing pot in a furnace this compound burned in a lively manner, being supplied with oxygen from the saltpeter in the mix. The pots heated very quickly but the compound shrank in volume about 20 per cent. and caked very badly.

4. Barium carbonate, wood charcoal and burned leather. The excellent carbonizing properties of this compound have been the cause of several concerns placing it on the market under different names, and in different proportions of these constitutents. One concern adds free ammonia, but its selling point is rather obscure, as the volatile nature of this gas prevents it from being a factor in the furnace reactions, as it would have

disappeared before the material was very hot. The prices charged for some of these compounds are not consistent with the value of their ingredients, and case hardeners who favor this form of a carbonizer can readily mix them at a saving in cost in the following proportions:

Ingredient	Per Cent.
Charcoal	50
Commercial barium carbonate	35
Charred leather	15

The charcoal should not be finely powdered, as it creates too much dust in mixing and packing, and the work to be carbonized has a tendency to settle in the pots when the mix is pulverient. These ingredients are best mixed in a tumbling barrel.

5. Surface hardening powder. This was sold for giving steel a surface hardness similar to that obtained by "cyanide." Analysis of this showed it to be a mixture of charcoal and pottassium ferrocyanide, and other tests proved it to be inferior to the ordinary cyanide as a hardener.

In spite of the many carbonizing nostrums on the market good, clean bone, free from moisture and fiber, is no doubt the best case-hardening substance sold. Its peculiar structure does not permit of shrinkage in volume, while its cellular formation, wherein the carbonaceous and nitrogenous matter is secreted, permits the evolving of the carbonizing gases at only a slow and uniform rate. The theory, fostered and abetted by those interested in the sale of "nostrums," that the phosphorus in the bone is absorbed in the steel and is the cause of brittleness is a fallacy, as the calcium phosphates are in no way decomposed by the reactions taking place in the carbonizing furnace.

Clutch Compounds

This compound has been sold to the automobile trade for use in clutches to prevent slipping. A sample removed from a friction clutch which had shown unusual and excessive wear proved on analysis to be composed of pulverized rosin and red oxide of iron. The latter being an abrasive known as rouge, naturally was very destructive to the disks in the clutch.

Clutch Fabrics

These are used for covering brakes and cone clutches, and a large number of them have unusual merit, but one of a suspicious red color was tested and found to be impregnated with rouge.

Aluminum Solders

This form of graft is gradually playing out, as knowledge of the properties of aluminum become more widely known. Some of these solders have been sold for prices as high as $4 per pound, but expensive solders are not necessary for this work, as an alloy of two parts of tin and one part of zinc, with a little copper to harden it somewhat, is an entirely satisfactory alloy, which can be made for about 35 cents per pound. (Some of these high-priced solders analyzed were found to contain these same metals.) To solder aluminum two things must be taken into consideration; first, the heat conductivity of the metal, and second, the formation of infusible aluminum oxide on the surface. Knowing these two facts, soldering becomes an easy matter, for it is only necessary to keep the surface to be soldered hot enough to keep the solder fluid, by means of a blow torch, and to carefully tin the surface of the aluminum so the metal will stick. No flux need be used, as the oxide, unlike that of copper, cannot be reduced, and a clean metallic surface presented for the solder to adhere to.

Lard Oil

This oil is used extensively for screw cutting, gear cutting and on millers, but mixtures of paraffin and lard or cottonseed oils give good service for this work. However, if the price is paid for lard oil, no concern desires to accept an adulterated product. The common adulterant of this oil is cottonseed oil, although other oils are also used. Lard oil containing over 10 per cent. of cottonseed when mixed with a silver-nitrate solution darkens perceptibly, due to the formation of black metallic silver. This test, while not sensitive to small amounts of adulteration, is very simple to perform by merely adding to the oil in a test tube an equal volume of an alcoholic solution of silver nitrate and heating. The solution used is made by dissolving one part of silver nitrate in 200 parts of 95 per cent. alcohol and 40 parts of ether. Good lard oil should be of a lemon-yellow color and should not congeal above 40 degrees Fahrenheit.

Soluble or Mineral Lard Oil

This oil, as its name implies, is a mixture of mineral with animal or vegetable oils, which on addition to water, carrying in solution a mild alkali, such as soda ash, borax or soap, form a milk-white fluid. The principle involved in this is that whenever an easily saponified oil (such as linseed, for instance) is mixed with a mild alkali or emulsifying agent, the entire mass of oil is thrown into a minute state of subdivision, so that the particles remain in a state of suspension in the medium.

The mineral oils must necessarily be of a good quality, such as spindle oil, but the saponifying oils are sometimes cheap animal oils, such as horse oil, which becomes rancid after a time and creates a disgusting odor, which is very unpleasant to the machine operators. Other mixtures contain drying oils, which eventually gum up the machines, forming a film on them which is removed with difficulty.

The principal trouble with these emulsions is due to the oil separating from the meustruum and gathering with it dirt, chips and soap, which form a "liver" in the liquid, which clogs up the pipes and causes endless trouble in the circulating system. There are several causes for this: First, if the emulsion flows over castings and parts which have previously been in a pickling or acid bath and still contain traces of the acid, due to improper washing, there will be a separation of the oil, as acid has this effect. Second, if the water is bad and contains large amounts of calcium and magnesium sulphates, there may be more or less separation. Third, the emulsifying of these oils is a chemical reaction and certain proportions only are necessary of water, oil and alkali; carelessness in mixing and treating the water is a common cause of trouble.

But the trouble may be in the compounding of the oil itself, for only in certain proportions and under certain conditions will a permanent emulsion occur and before an oil is accepted this matter should be determined. To make this test proceed as follows:

To one ounce of soda ash add one gallon of water and allow it to remain one hour before using. Then mix in a small bottle (such as are used for samples of oil) the water and the oil in the same proportions it would be made up for use on the machine and allow it to stand for 24 hours. If after this period of time has elapsed the emulsion has separated in two or more layers, it should be rejected.

Gasolene

Gasolene is mostly adulterated with the heavier distillates of petroleum. The specific gravity is not always a reliable test for this oil, as it is said this can be doctored to bring it within any range desired. A simple test for foreign oils is to place about a spoonful on a sheet of white paper. This should evaporate without leaving any stain.

Gas Engine Oils

This should be an amber-colored oil with not over one-half per cent. of free carbon. Oils containing over this amount are darker in color. They should also be free from mixture with animal or vegetable oils although they are sometimes adulterated with these. They should be freed from carbon by filtration through bone black or fullers earth and not bleached with acids as traces of this are very corrosive. A test for acid can be performed by shaking a portion of the oil with water and testing with blue litmus, which will turn red if acid is present. Oils containing graphite should never be used; this remains in the combustion chamber as it does not volatilize by the explosion of the gas. The carbon removed from one automobile engine

subject to premature firing proved on analysis to be about 75 per cent. of graphite.

Greases

Greases are made for so many different purposes and compounded in such varying composition that it is difficult to state what is pure and which is an adulterated article. Frauds in this commodity consist mostly in substituting an inferior grease for a high-grade lubricant. In some cases substances will be found in these greases which have no lubricating value, such as ground cork or wood, rosin, lamp black, tar, pitch, lime, bleaching powder and oil thickeners, such as the palmitate and oleate of aluminum. Greases are often made by adding a lime or rosin soap to mineral oil. Petrolatum or vaseline is also used as a lubricant. For some purposes in these greases are also incorporated graphite, talc, mica and petroleum residue. Tallow is in many compounded greases, but as it often contains free acid, which has a corrosive action on the metal it comes in contact with, its use is not recommended for bearings for this reason. While the variety of greases are numerous, much can be ascertained by a few simple tests. By heating the oil to 400 degrees Fahrenheit an inferior grease will separate and be rendered worthless. To determine the presence of heavy matter place a small amount of the grease in water and if so adulterated it will sink in liquid.

Belt Greases

These are used for the double purpose of causing the belts to adhere to the pulley and to soften the leather. Some of these contain degras, an oil used in the leather industry which, while it has the effect of softening the leather, will eventually destroy the belting. Some of these dressings are simply rosin and soap, others are composed of tallow, castor oil, fish oil and rosin. Unvulcanized rubber is used in some greases, being dissolved in turpentine and mixed with fish oil and tallow to the proper consistency.

Pigments

The use of paints is general to more or less extent among the industries, and as adulterations are common in these lines, brief mention will be made of them.

White lead. The chief adulterant of this is barytes or barium sulphate, a heavy compound of little value as a pigment.

Lamp black. This being a condensed smoke the minute division of the particles makes it a valuable pigment. The chief adulterant is charcoal. Lamp black should vaporize completely when ignited in a porcelain or platinum dish and have no residue whatever.

Bone black. There are two grades of this, the ordinary and the purified, or ivory black, the latter being treated with muriatic acid to dissolve the bone phosphates. After ignition the former should not contain much over 10 per cent. of carbon and the latter not over 2 per cent. of residue. The chief adulterants are wood charcoal, coal and coke dust and various other mineral blacks.

Of the colored paints, the cheaper, such as ochers and umbers are not as subject to adulterations as more expensive compounds like vermilion, which is sometimes mixed with the cheap iron colors and red lead. The analine dyes are also used to adulterate all the colored pigments but their presence can readily be determined by placing a small amount of the powder on a piece of clean white paper and pouring on it about a dozen drops of alcohol. If the pigment contains these coal-tar dyes the paper will be stained, but if pure this will not occur.

The methods of testing for purity given under the previously mentioned subjects, though crude, may be performed by any person not familiar with chemical terms and processes and should be a valuable guide in ascertaining the existence of adulterants in those articles. While it is realized that many concerns dealing in these commodities do not indulge in these deceptions and furthermore, that some compounds whose ingredients are still trade secrets possess real merit, there is, unfortunately a large class who flood the market with worthless imitations, spurious substitutions and mysterious mixtures of all descriptions. These are the "parasites of industry" whose profits are diverted from the legitimate manufacturers.

Tin Plate Scrap

As is well known, the utilization of bright tin scrap has been carried to a high degree of perfection. The cutters of large shapes usually sell their scrap to button, badge, or roofing-cap manufacturers, who in turn sell their clippings to the detinners, who treat them either by an electrolytic or a chemical process, recovering tin or tin chloride and a mild-steel scrap. This scrap, when cabbaged, is eagerly sought by the iron and steel men, whereas the tin scrap can be melted only for heavy castings on which no especial strain is to be placed.

The treatment of the bright scrap is marked by no special difficulties, as it packs well, as a rule, and has no foreign matter to contaminate either the treating solutions or the product. However, the treatment of old tin cans has not made advances corresponding to those in the recovery of tin from bright scrap, the tonnage treated of the latter being for the world probably in excess of 175,000 tons yearly. Except for the goat, the old tin can has but few friends. Although they are used to some extent in mining camps as a precipitant for cupriferous mine and concentrator waters, and have, in some cases, been used as a ferruginous flux in cases of shortage of iron-bearing fluxes, the ordinary mining camp is marked by an encircling ring of old tin plate. Even in the cases cited above, where the old tin can is used, the tin is not recovered, as the copper refiners have not yet found enough of the metal in their slimes to make it a recoverable byproduct.

Around the city the tin can is scarcely less of a landmark, though seen only by the traveler in or out, thanks to garbage removal. There have been many efforts made to solve the problem of tin-can recovery, including electrolytic tin plants, using alkaline-hydroxide baths; deheading and desoldering devices, with attempted use of the recovered plate either for roofing caps or, after removal of the tin, for lye cans; chemical recovery by hydrochloric-acid baths; and detinning by a centrifugal machine after heating. These processes have all proved failures, from two great underlying causes: the great bulk of the article for a given weight prohibiting long-distance shipments to any large central plant, or economical treatment when there; and the dirt accompanying the can, consisting of ashes and garbage. This dirt is expensive to remove, while, if left in, the electrolytic slime or chemical solution is an untreatable mush.

Previous crushing and rending of the cans to insure cheaper carriage and treatment, seem questionable, as it appears that even with the present price of tin, a portion of the iron must be marketable as black plate, to cover washing charges. These conditions may not be true in Europe, as it is stated that the Goldschmidt works in Germany is treating old cans, although it is difficult from the information given to know whether these are clean, imperfect cans, or what are known in this country as swill cans.

There seems no question but that with the various civilized governments specifying higher percentages of tin on the plate used for cans, and a decreasing tin supply, the old tin-can question is of some importance, but up to date the two chief metallurgical uses, the recovery of old can solder by heating the cans, a process often carried on by the ubiquitous Chinaman, or the melting into sash weights, take no account and make no recovery of the tin.

Reinforced-concrete construction for industrial buildings costs 6.4 per cent. less than fireproofed structural steel and 6.7 per cent. more than mill construction, according to J. P. H. Perry in a paper presented to the National Association of Cement Users. The figures are based on buildings of various sizes erected in different parts of the country. Cases are cited of steel buildings costing 10 to 13 per cent. more than the concrete structures and of concrete buildings costing even 27 per cent. more than mill construction.

Factors in Machine Molding*

By Wilfred Lewis†

The importance of time study in the foundry is emphasized by a comparison of molding a certain pattern, first, by hand; second, on a machine. The time in the second case is one-half that in the first.

A discussion of the principal types of molding machines, pointing out some of the limitations.

A series of illustrations showing the molding of a wheel on a combination jarring and roll-over machine.

*Abstract of a paper presented to the Franklin Institute.

†President, the Tabor Manufacturing Company.

Like any other equipment, the installation of molding machines must depend upon the saving to be effected by their use and the outlay needed to effect that saving. This leads at once to the consideration of foundry costs, the analysis of which should point the way to their reduction. These costs are made up of many important elements beyond the scope of my subject, and I propose to consider the effect of one item only, that of machine molding, leaving all other items to be treated in the same way by those who are interested in attaining the highest efficiency in every detail of operation.

Machine molding began on small work, and probably one of the best known appliances is the little hand squeezer. This is a very simple and effective machine, designed to save part of the time consumed in ramming.

The little power squeezer is adapted to the same class of work as the hand squeezer, which saves the work of ramming but puts upon the operator the work of squeezing. There the man still does the work, but with greater despatch and therefore more efficiently. Here the machine does the squeezing and the operator can keep fresher and work faster.

In support of this statement 270 molds have been put down by one man in six hours, and we understand that this daily performance has recently been increased to 325 in the foundry of the American Hardware Corporation, where nearly 100 machines of the same type can be seen at work. Of course, these performances by expert operators are not to be expected along the whole line, where the average may be in the neighborhood of 200 molds a day, but they show what is possible, if not always probable, and it remains to be seen how a proper day's work on any given pattern can be fairly estimated.

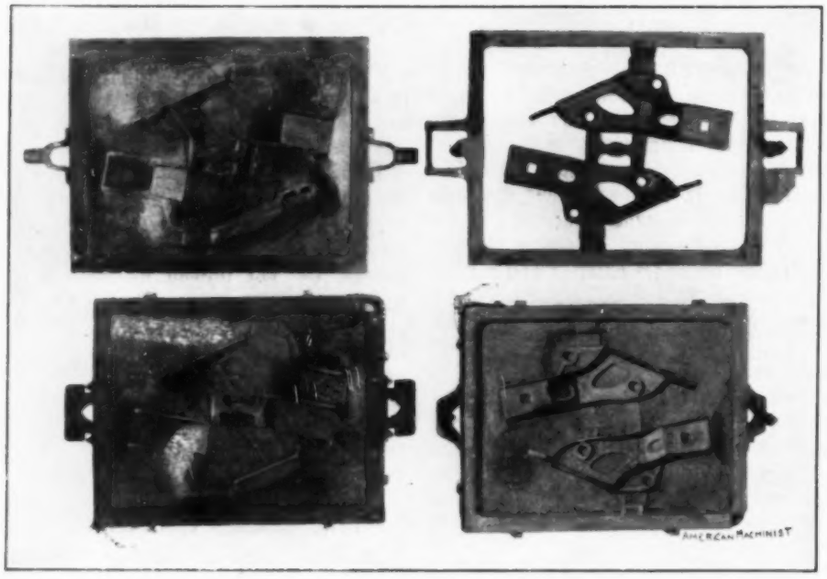


FIG. 1. A PAIR OF SMALL PATTERNS MOUNTED IN A VIBRATOR FRAME FOR USE ON A SMALL POWER SQUEEZER

We are frequently asked to say what our machines will do and what production we will guarantee, regardless of the fact that we never know anything about the man behind the machine and seldom very much about the patterns to be used, the cores to be set or the precautions found necessary to insure success in molding the same patterns by hand. We know in a general way the type of machine required, but until we have actually made molds and poured castings, we are at a disadvantage and cannot safely guess at results, which should be determined from a careful analysis of the experience gained in molding by hand. The foundryman contemplating the introduction of machines has had the necessary experience, but he seldom, if ever, has it in shape available for analysis, and I propose to show the importance of making observations in detail and recording the time required for each and every step taken in the production of a mold.

This has been brought out very forcibly by Mr. Knoepple in the April number of the *Engineering Magazine*. The suggestions there made are in line with the practice of the Tabor Manufacturing Company for the last five or six years, but the matter is one that has only begun to receive the attention it deserves as an important feature of scientific management. Fig. 1 shows a pair of small patterns mounted in a vibrator frame, 13x17 inches, for use on a small power squeezer. There are shown the patterns, the hard-sand match, cope and drag ready to close. This is not a difficult pattern to mold by hand, and it may not appear to be worth while to put it on a machine, but if we mold it by hand and note down the time taken by every step in the process, we shall see where to look for a saving and what to expect.

Fig. 2 shows the result of observations taken on molding by hand by an experienced man with a stop watch. The time is taken in minutes and hundredths for convenience in summing up. Items 4 to 11, inclusive, have to be done in the same way, and will consume the same time, 0.45 minute, whether the mold is made by hand or by power, as will appear in Fig. 3.

Item 12 must be done more thoroughly and takes more time when the mold is completed by hand. Item 13 is not required for machine molding. Item 14, butt ramming 0.30 millimeter, is equivalent to squeezing by power, but it takes five times as long. Item 15, striking off, is performed after ramming and takes 0.03 minute longer than striking off the unrammed sand on the machine. Item 16 is not required in machine molding. Item 17, rolling over, is the same in both cases. Items 18 and 19 take 0.14 minute and only 0.08 minute when compressed air is used on power machine.

Items 20 and 21 are the same for hand or power molding. Item 22 shows 0.56 minute by hand against 0.18 by power. Item 23 is not done by power as a separate operation. Item 24 is the same in

both cases. Item 25, to rap pattern, takes 0.48 minute against 0.12 minute to start vibrator and lift cope at one operation on machine. Item 26 is the same in both cases. Item 27, remove cope, takes 0.09 minute. Item 28, blowing off pattern with bellows, takes 0.04 minute longer than with compressed air. Item 29, drawing pattern, takes 0.35 minute longer. Item 30, patching up, 0.30 minute, is not called for on machine.

Items 31, 32 and 33 are the same in both cases and in molding by power an additional operation, stopping off carriers, 0.06 minute, is required.

Fig. 3 shows the operations in detail for molding the same patterns on the machine. There are 30 operations by hand, footing up 4.20 minutes, and 27 operations on the machine, footing up 2.10 minutes, making the machine time just one-half of the time required when molding by hand without the use of compressed air.

It is also apparent from a study of these time tables that the use of compressed air alone instead of bellows will effect a saving and that the vibrator in connection with hand molding will also effect a greater saving. Making the necessary substitution in Fig. 2 for the use of blower and vibrator it will be found that this additional equipment alone would reduce the molding time from 4.20 to 3.06 minutes. It, therefore, appears that the blower and vibrator can be used to save 1.14 minutes per mold and the squeezer 0.96 minute more. This looks as if the blower and vibrator alone saved so much that it might not be worth while to put in the machine; but if we look again at the increased production, taking hand work as the basis for comparison, we see that the output from the use of the former is $\frac{4.20}{3.06}$ or 1.38, while from the use of the latter it is $\frac{4.20}{2.10} = 2$, that is, an increase of only 38 per cent on hand work against 100 per cent. on machine work.

But it may be argued that another element of time remains to be considered, and it may be admitted that no account has yet been taken of the time required to distribute a large number of molds on the floor. I do not know how far a mold can be carried and placed on the floor in 0.06 minute, the time noted, but this time should be taken to about the middle of the space to be covered, and perhaps some additional time should be allowed for this item. On the other hand it may be said that no allowance has been made for the inexperience of the operator, who was in this case a pattern fitter and not a molder or demonstrator. The time given will vary with different men and it was taken in these cases simply for the purpose of illustrating the method by which important conclusions can be reached. No better data can be obtained for fixing prices and when time is taken by an observer of experience, who understands his business, the stop watch never runs unless useful work is being done in the right way. A reasonable allowance should always be made for contingencies and a bonus put upon the performance of the work specified in the allotted time.

When patterns are cast in an aluminum match plate, as shown in Fig. 4, both cope and drag can be squeezed at the same time, the number of operations on the machine is reduced from 27 to 25 and the total time from 2.10 to 1.76 minutes.

Description of Operation Molding Drag & Cope (Part of Plow)

Flask 13″x17″. 4″ Drag, 4½″ Cope. January 1, 1911. Power Squeezer.

Item	Detailed Instructions	Feed	Speed	Element Time per Piece	Time for Entire Lot	Continuous or Running Time
1	Preparation					
2						
3						
4						
5	Pick up hard sand match and put on table of machine			0.04		
6	Pick up pattern and put on hard sand match			0.04		
7	Pick up drag and put in place			0.07		
8	Shake parting on pattern			0.08		
9	Pick up riddle and put on flask			0.02		
10	Fill riddle with sand			0.04		
11	Riddle sand on pattern			0.08		
12	Fill up drag. 3 shovels full			0.08		
13	Pein around edge of drag. (Butt of shovel)			0.05		
14	Strike off with board and put in place			0.07		
15	Bring yoke over and squeeze. 60 lbs. pressure			0.08		
16	Roll mold over (on table)			0.08		
17	Start vibrator and remove hard sand match			0.03		
18	Blow off with compressed air			0.05		
19	Repeat operations from 7 to 11 inclusive for cope			0.29		
20	Fill up cope, 4 shovels			0.10		
21	Repeat operations 13, 14 and 15 for cope			0.18		
22	Remove cope board			0.03		
23	Blow mold off with compressed air			0.05		
24	Cut sprue hold			0.08		
25	Start vibrator and lift cope			0.12		
26	Blow mold off with compressed air			0.05		
27	Start vibrator and draw pattern			0.10		
28	Close mold			0.12		
29	Remove flask			0.07		
30	Stop off carrier			0.06		
31	Place mold on floor			0.06		
32				2.10		
33						
34	Number 4 riddle					
35						
36	Weight of shovel 5 lb.					
37	Weight of sand 16 lb.					
38	Total weight 21 lb.					
		4 Month	20 Day	11 Year	Signed / Checked	DVM

FIG. 2. DETAIL OF TIME STUDY OF HAND MOLDING

Fig. 5 shows patterns mounted on a steel plate and when split or flat back this is a very convenient method.

They may be mounted on a paraffined board held in a vibrator frame, and when so arranged the molding time is substantially the same as for the aluminum match-plate mounting.

Some people imagine that by increasing the size of flask and putting in more patterns greater production can be obtained, but this is seldom the case. The greatest output comes from medium-sized flasks easily handled by one man.

Transfer-plate Method of Securing Half Patterns to the Plates

Fig. 6 shows a set of patterns mounted for a split-pattern molding machine, the cope and drag being molded from a double set of half patterns, the impression of the right-hand set in the drag matching those of the left-hand set in the cope and, similarly, the left-hand set in the drag matching the right-hand set in the cope.

The securing of these two sets of half patterns to the plate in a manner to insure accurate matching of cope and drag can be best accomplished by the transfer-plate method.

The first operation in preparing such a set of patterns is to make the pattern plate, drilling in it two dowel holes, one of which is shown in Fig. 6 at the end of the gate. These holes are drilled from a jig supplied with the machine, and their location defines the center line of the plate. For the case shown four complete patterns are first made, the two halves being doweled together as usual before turning.

They are then numbered and separated, and the halves without dowel pins are located on one side of the pattern plate and used as jigs to drill that side of the plate, as shown in Fig. 7. It is necessary to repeat the holes thus made on the opposite side of the plate and these must bear the same relation to the center line of the pattern plate.

To insure this a transfer plate of rather more than half the size of the pattern

DESCRIPTION OF OPERATION Molding Drag and Cope (Part of Plow).

January 1, 1911.

Flask 13"x17". 4" Drag, 4½" Cope. Hand Molding at Bench.

Item	DETAILED INSTRUCTIONS	Feed	Speed	Element Time per Piece	Time for Entire Lot	Continuous or Running Time
1	Preparation					
2						
3						
4	Pick up hard sand match and put on bench			0.04		
5	Pick up pattern and put on hard sand match			0.04		
6	Pick up drag and put in place			0.07		
7	Shake parting on pattern			0.08		
8	Pick up riddle and put on flask			0.02		
9	Fill riddle with sand. One shovel full			0.04		
10	Riddle sand on pattern			0.08		
11	Fill drag with sand. (3 shovels full)			0.08		
12	Pein around edge of drag and butt ram some (with shovel butt)			0.10		
13	Put two more shovels full in drag			0.06		
14	Butt ram			0.30		
15	Strike mold off with bar ¾x1x36 long			0.10		
16	Pick up bottom board and place in position			0.08		
17	Roll mold over			0.08		
18	Remove hard sand match			0.07		
19	Blow sand off of mold (with bellows)			0.07		
20	Repeat operations 6 to 10 inclusive for cope			0.29		
21	Fill cope with sand, 4 shovels full			0.10		
22	Repeat operations 12 to 15 inclusive for cope			0.56		
23	Mark sprue hole (with cope board)			0.05		
24	Cut sprue hole			0.12		
25	Rap pattern, spike going through sprue hole into pattern			0.48		
26	Round sprue			0.10		
27	Remove cope mold			0.09		
28	Blow pattern off with bellows			0.09		
29	Draw pattern from mold by hand			0.45		
30	Patch up mold (with slick)			0.30		
31	Close mold			0.12		
32	Remove snap flask from mold			0.07		
33	Remove mold to floor			0.07		
34				4.20		
35	Number 4 riddle					
36						
37	Weight of shovel 5 lb.					
38	Weight of sand 16 lb.					
	Total weight.....21 lb.					
		4 Month	19 Day	11 Year	Signed	DVM.
					Checked	

FIG. 3. DETAIL OF TIME STUDY MADE ON MOLDING MACHINE

plate is made. Holes to match the center-line holes of the pattern plate are drilled, the transfer and pattern plates are placed together, dowel pins are inserted in the center-line holes, and the two plates are placed under the drill press with the pattern plate on top, as shown in Fig. 8.

In this position the pattern plate is used as a jig to repeat its pattern-pin holes in the transfer plate.

The transfer plate is then turned over, not around, on the pattern plate, as shown in Fig. 9, the center dowel pins are reinserted, and the transfer plate is used as a jig to drill the holes in the second side of the pattern plate, all as shown in Fig. 10. When the transfer plate is removed, the pattern plate appears as shown in Fig. 11; obviously the second set of holes must be truly symmetrical with the first set and the half patterns when doweled to these two sets of holes, due regard being paid to their numbering, must also be truly symmetrical and produce perfect joints when molded.

SPLIT-PATTERN MACHINES

Split-pattern machines have been on the market for many years and their value is recognized and appreciated, but unfortunately they have to be built for a flask of fixed dimensions, or at least fixed in length or width to fit the flask pins on the machine. They are expensive to build, rather inflexible in their application, and within the last few years they have been superseded very largely by

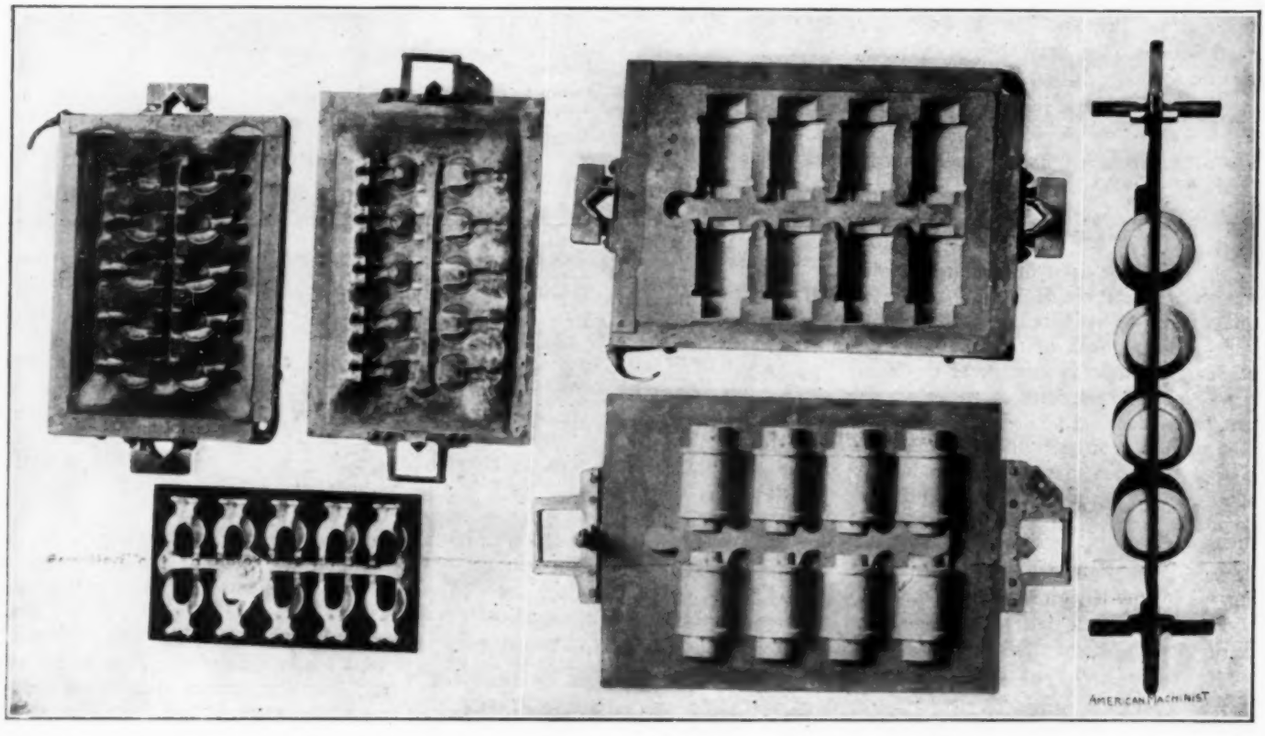


FIG. 4. PATTERNS CAST IN AN ALUMINUM MATCH PLATE

FIG. 5. PATTERNS MOUNTED ON A STEEL PLATE

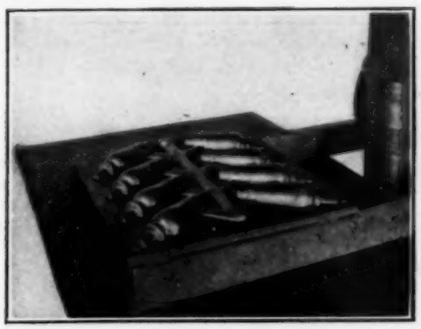


FIG. 6. SET OF PATTERNS FOR SPLIT PATTERN MOLDING MACHINE

FIG. 7. DRILLING THE PATTERNS ON TO THE PLATE

FIG. 8. DRILLING HOLES ON THE TRANSFER PLATE USING THE PATTERN PLATE AS A JIG

FIG. 9. TRANSFER PLATE USED FOR A JIG TO DRILL SECOND SIDE OF PATTERN PLATE

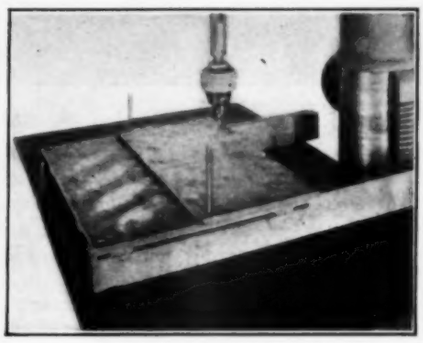


FIG. 10. TRANSFER PLATE USED FOR A JIG TO DRILL SECOND SIDE OF PATTERN PLATE

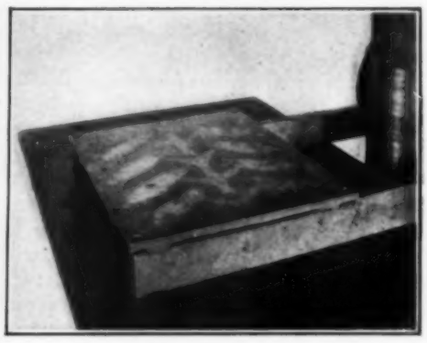


FIG. 11. COMPLETING DRILLED PATTERN PLATE

roll-over machines with straight pattern draft to ram by hand or by power. An ingenious hand-ramming roll-over machine with mechanism for rapping the pattern carrier and dropping the flask from the pattern was brought out by Teetor in 1889.

Plated patterns are carried in a roll-over frame, to which the flask is clamped and rammed in the usual way by hand. When rolled over, the support beneath is brought up by the hand lever, the flask is unclamped and the pattern rapped by turning the handwheel on the trunnion shaft. At the same time the pattern is drawn by lowering the flask. A few of these machines can still be found in use, but the rapping mechanism is not durable, the machine is rather limited in its scope and other types have displaced it for some time.

The French machine of Bonvillain & Ronceray is a modification of this type, in which the outer trunnion is omitted and power is added for squeezing the mold and drawing the pattern.

THE JARRING MACHINE

The development of the jarring machine is an interesting study, but I cannot undertake to follow it through all its ramifications, and shall confine myself to a few examples with which I have had some experience during the last 10 years. In the beginning I built machines in which the jarring table was struck beneath by a heavy plunger actuated by compressed air. The blow raised the table a short distance from its support, upon which it fell back, striking a second blow. Some of these machines are still in use, but it cannot be said that they are very efficient or successful, and they were superseded five or six years ago by a plain machine with the jarring cylinder

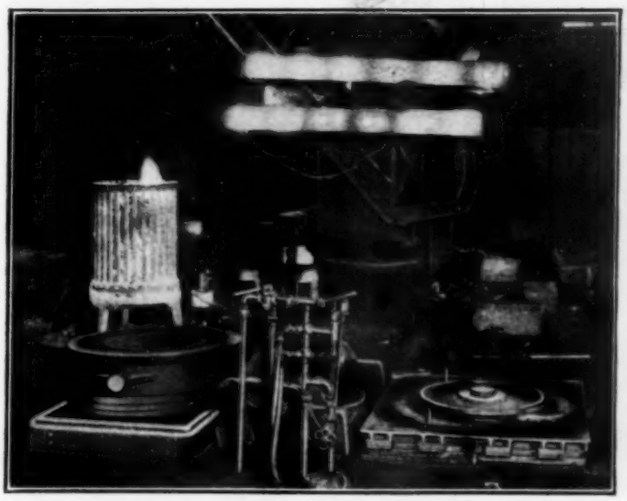


FIG. 12. FINISHED HALF OF A WHEEL MOLD AND PATTERN PLATE ROLLED BACK

FIG. 13. NEW FLASK IN PLACE COVERED WITH SAND FRAME

FIG. 14. WHEEL MOLD RAMMED AND SAND FRAME REMOVED

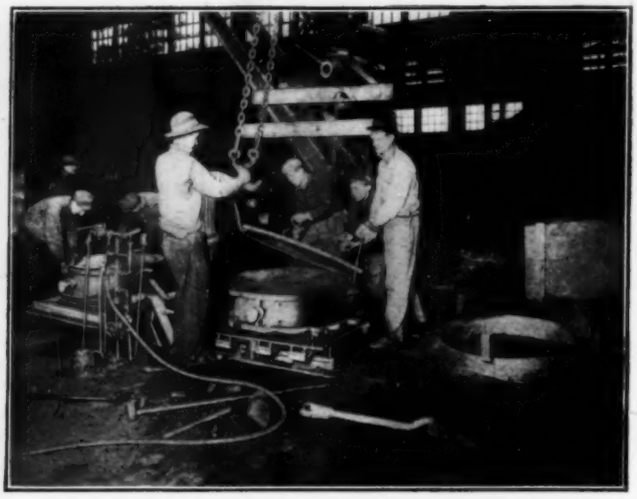


FIG. 15. BOTTOM BOARD READY TO CLAMP ON

formed in the table mounted upon an upstanding plunger. By this construction, the table is given enormous strength and stiffness and the central blow of impact is distributed equally in all directions. The plunger is part of a heavy piece of cast iron forming the anvil, which in turn rests upon a large mass of concrete. Originally the main valve was operated directly by tappets attached to the table, which could be adjusted for any desired length of stroke, and later it was modified to operate through the medium of a pilot valve. To avoid unnecessary intensity in the blow struck by the table upon its anvil, a few layers of leather or other nonresilient material are introduced as a cushion. These reduce the wear and tear and noise, without having any material effect upon the action of the machine on the sand.

As to the mass of concrete, it may be said from the operating standpoint, the more the better, but this must be limited, of course, with regard to the cost and the natural bed beneath. We recommend, in a general way, about two cubic feet of concrete for every square inch of area in the jarring cylinder; but if there is a rock bottom beneath, we would advise the use of very little concrete, or just enough to level up under the cast-iron plunger base. Some builders recommend more concrete than we do, some less, and in addition to the concrete a heavy, wooden cribwork is frequently put in beneath to prevent the transmission of the shock of impact into the ground. This is in accordance with the usual practice under steam-hammer anvils, and it may have some beneficial effect, but it does not eliminate the whole trouble and we do not consider the wooden crib worth its additional cost.

It is not generally safe to set up finished molds with hanging sand in the neighborhood of a jarring machine of this type and I have seen foundries in which the jarring machine has been put out of commission for days or weeks pending the completion of large floor work. In fact, the damaging effect of large jarring machines is too well known to need confirmation and to reduce this to a minimum the drop of the table has been decreased while the foundation has been increased.

But there is a limit to the relief afforded by reducing the drop, because upon this the ramming effect primarily depends. The shorter the stroke the less the ultimate density attained and the less the efficiency of the machine. This can

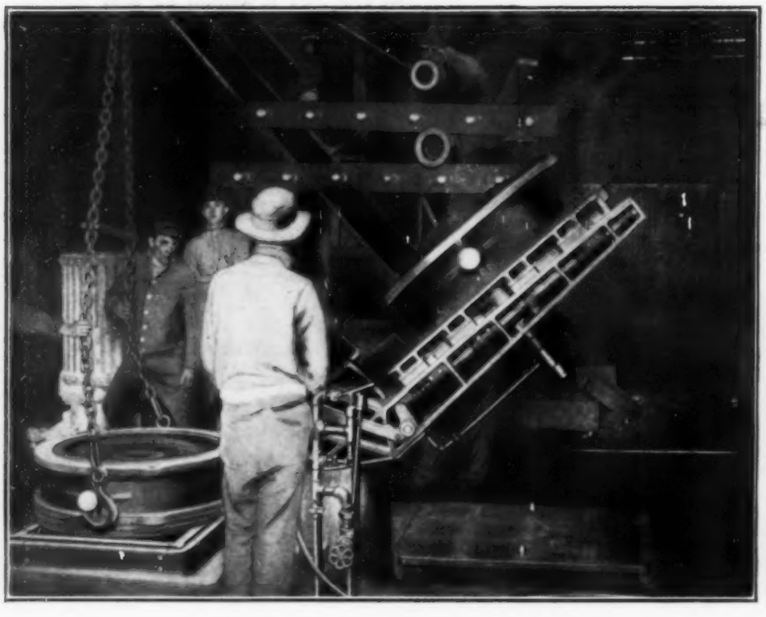


FIG. 16. ROLLING OVER THE NEW MOLD

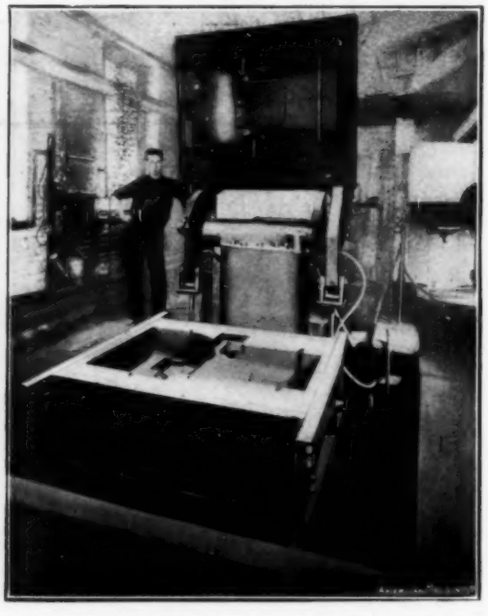


FIG. 17. GRINDER FRAME MOLD MADE IN SAME MACHINE

be demonstrated in a practical way by ramming up a deep mold on short strokes until the sand ceases to pack any further; then increase the length of stroke very considerably and watch the effect of the next blow. The sand will pack further immediately and the conclusion in favor of the long stroke as more efficient in packing sand is inevitable.

The shockless jarring machine has therefore been designed to eliminate ground shock and retain the use of any stroke desired. It requires no foundation other than a base to sustain the static load upon it, and it is more efficient in operation than a plain machine mounted on a wooden crib whose anvil weighs twice as much.

The plunger base forming the anvil is mounted for convenience in an anvil cylinder and rests upon a number of long compression springs. When air is admitted to the jarring cylinder, the entire weight of the anvil, table and load is carried upon these springs and they are therefore compressed and in readiness to expand when the air is exhausted and the table falls. At the beginning of this movement the loaded table is impelled downward by the same force that moves the anvil upward. Although some of the force of the springs is exhausted as the anvil rises, the loaded table and the anvil acquire substantially equal momenta which neutralize each other when impact takes place. To compensate in a measure for the loss of spring pressure as the anvil rises, the exhaust from the jarring cylinder may be carried into the anvil cylinder before being discharged.

The combination valve controls this action. This consists of a large main valve of the steam-hammer type in connection with a small pop valve such as is used on the small power squeezers and split-pattern machines. These valves are attached to the anvil or plunger base and the pop valve is opened and closed by tappets on the jarring table. When the table drops the pop valve opens, admitting pressure beneath the main valve, which rises and puts the jarring cylinder in communication with the air supply, at the same time opening the anvil cylinder to exhaust.

When the limit of stroke is reached the pilot valve opens to exhaust and the main valve drops to the position shown. The air from the jarring cylinder rushes into the anvil cylinder, expanding to much lower pressure which is nevertheless very effective in the large anvil cylinder and causes the loaded table and anvil to collide with greater force and effect upon the sand. The supply of air to these valves is controlled by an air cock at the operating stand and the table runs automatically as long as the air is turned on. At the same time the stroke of the table is controlled by another lever which may be adjusted, if desired, while the machine is running. The purpose of the pilot valve is to provide a controlling means, easily manipulated, which will give the delayed action required by the main valve. This always presents full openings during the table movement up or down, and the ample lap on the ports gives time for expansion in the jarring cylinder under light or medium loads after the air supply has been cut off. Of course, under full load, or thereabout, there can be no appreciable expansion in the jarring cylinder.

Some Interesting Wheel Molds

Fig. 12 shows a power roll-over machine in combination with a jarring machine at work in a large wheel foundry. A half mold on the left has just been finished and the pattern plate has been rolled back ready to receive another flask. Fig. 13 shows a new flask in place, covered by a sand frame to carry the excess sand. The new mold is ready to jar ram and a crane is nearby to remove the finished mold. Fig. 14 shows the mold rammed and sand frame removed. Fig. 15 shows the bottom board ready to clamp on. Fig. 16 shows the machine in the act of rolling over the new mold while the finished mold is being removed.

Fig. 17 shows a grinder frame made on the same machine. This half mold was made by two men in 10 minutes and a complete mold, including core setting, could probably be made in half an hour. Originally two men made two molds a day by hand. With the aid of a jarring machine they made five a day and it appears from the time taken on a combination machine that 20 a day might be expected.

Factory Fuel Oil Burners

By F. C. Perkins

The accompanying illustrations show the modern use of factory fuel-oil burners for boiler shops and machine shops.

Fig. 1 shows one of the burners at work in flanging boiler shells. An offset 8x14 inches was made without removing the shell and heats 30 inches long were taken every four minutes. The flame was inclosed in a sheet-iron box.

Fig. 2 shows an oil burner in operation straightening and welding engine frames. The burner is used to advantage in similar work, expanding and shrinking in boiler and street-car repair works.

Fig. 3 shows one of the burners in operation in Van Stone flanging. The average time required for heating was 4 minutes on 10-inch pipe. The same burner is used for pipe bending, save that the pipe is moved to and from the fire. A removable baffle sleeve of sheet iron is used to inclose the pipe above 5 inches in diameter.

One of the questions under consideration by the standardizing committee of the Society of Automobile Engineers is the standardization of chamfers in ball bearings, in connection with which the New Departure Manufacturing Company, Bristol, Conn., has presented the society a set of six rings and plug gages intended to show the relative merits of the straight chamfer and the conventional radius type. The advantage claimed for the straight chamfer is that while it is more easily machined, it clears the shaft fillets much more readily than does the round corner cone, as it allows a greater variation in the shaft filler.

Fig. 1. Flanging Boiler Shells

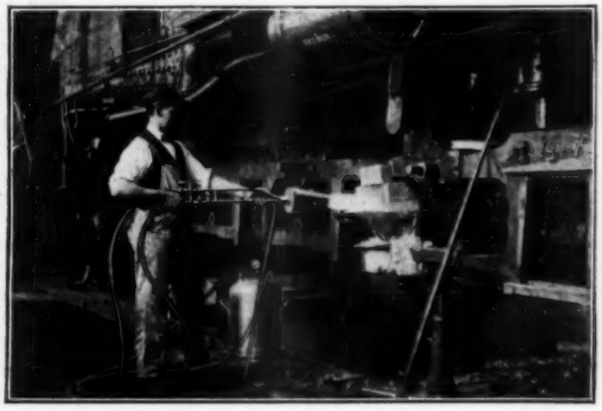


Fig. 2. Straightening and Welding Engine Frames

Fig. 3. Van Stone Flanging

Methods of Hardness Measurement*

By Ralph P. Devries

A comparison of five methods of testing hardness, more particularly of metals. The results of the ball and cone tests are comparable, but there is a divergence between the results of the Brinell and Shore methods for those metals which contain elements whose presence is generally supposed to contribute toughness rather than hardness. Here the scleroscope indicates a much higher hardness than the Brinell press.

*Paper presented to American Society for Testing Materials.

More or less theoretical definitions of hardness have been proposed at various times. The tests based upon these definitions have in some cases been impractical. More often have they failed to give information concerning hardness that conformed to the ideas of the workshop and to the demands of actual practice. Any hardness test of metals in order to be successful must conform to the conception of hardness which is held by the men whose interest in this form of test is entirely a practical one. The increasing need of accurate information concerning hardness has resulted in the development of the hardness tests which are in use at the present time.

After looking over the field it was determined to investigate only those methods which seemed the most promising of

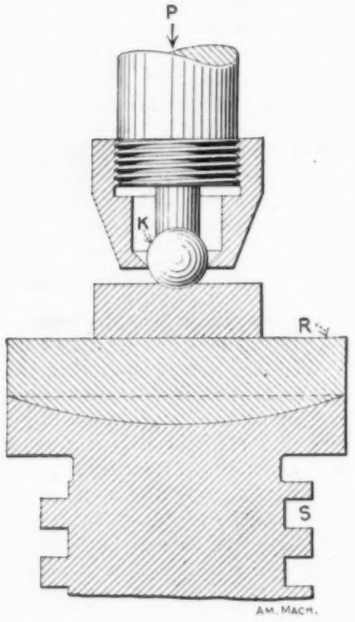


FIG. 1. SKETCH OF BRINELL TESTER

results and which have recently been developed.

The object of this investigation is to determine whether any agreement exists between the results obtained by methods which are apparently in no way related to each other.

Load, Kilograms	VALUES OF R′ IN CM. FOR Bessemer Steel	Cast Iron	Tobin Bronze	Cu.-Vd. Alloy	Manganese Steel
500	5.71	6.71	6.31	6.72	7.64
1,000	5.79	6.46	5.83	6.46	6.98
1,500	5.73	6.26	5.43	6.26	6.59
2,000	5.59	6.16	5.13	6.16	6.24
2,500	5.56	6.05	5.05	6.05	5.70
3,000	5.57	5.91	5.06	5.91	5.43

TABLE 1. RADII OF CURVATURE OF INDENTATION FOR DIFFERENT METALS

METHODS INVESTIGATED

1. The Brinell method is based upon determining the resistance offered to indentation by a hardened sphere when the sphere is placed on the metal under investigation and subjected to a given pressure.

2. The cone test depends upon the same principle as that of the sphere, except that a circular cone of 90 degrees angular opening is substituted for the sphere.

3. The Shore scleroscope is a method which depends on the hight of rebound of a hardened-steel hammer when it is dropped onto the metal under test.

4. The Bauer method depends upon the rate at which a steel drill running at constant speed and under a constant pressure drills the metal under test.

5. The Ballantine method depends upon the amount a leaden disk is indented, when it transmits the energy of a falling hammer through an anvil onto the metal under test.

THE BRINELL TEST

The method of carrying out a hardness test as recommended by Brinell was to indent the metal under test with a sphere 1 centimeter (0.4 inch) in diameter subjected to a pressure of 500 kilograms (1100 pounds) for the softer, and 3000 kilograms (6600 pounds) for the harder metals. He defined the hardness as the pressure in kilograms per square millimeter of spherical indentation.

After this method was introduced it was shown by Benedicks, Le Chatelier, Leon, Malmstrom, Meyers and others that the hardness numeral is dependent upon the size of the sphere and the pressure to which it is subjected. Meyer calculated the hardness numeral by dividing the load of the projected area of the indentation; but shows clearly that the determination of two constants is necessary for the accurate measurement of hardness.

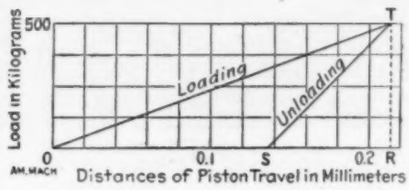


FIG. 2. TYPICAL CURVE OF LOADING AND UNLOADING IN THE BRINELL TEST

Martens and Heyn have shown that a linear relation exists between the load and the depth of indentation for very low pressures and have suggested as the hardness numeral, the load which is required to produce an indentation of 0.05 millimeter (0.0021 inch) in depth. Since this method of determining the hardness eliminates the necessity for any arbitrary assumption it was determined to investigate further the relation between load and depth of indentation at both low and high pressures.

DESCRIPTION OF METHOD

Fig. 1 shows a sketch of part of the Brinell apparatus. The test piece is placed on the head *R*, which is brought into contact with the 1-centimeter (0.4 inch) sphere by means of the screw *S*. A small initial pressure is applied to the piston *P*. A micrometer microscope reading to one-one thousandth millimeter (0.00004 inch) is focussed upon a line drawn upon the piston, and a reading taken. The desired pressure *X* is then applied and released to a point of initial pressure before the final reading is taken. The difference between the initial and final reading is equal to the depth of indentation of the sphere.

Fig. 2 shows a typical curve of loading and unloading. In this figure *O R* represents the entire downward travel of the piston. The distance *O S* is the actual depth of indentation. It is equal to *O R* minus *S R*. The distance *S R* represents the compression of the sphere, piston and all parts of the apparatus lying below the reference line.

The depths of indentation were measured for a series of metals at varying pressures. The curves plotted in Fig. 3 are typical of the results obtained. They show the existence of a linear re-

lation between load and depth of indentation for pressures ranging from 0 to 3000 kilograms (6600 pounds).

The total downward travel of the piston was measured for several metals. These results are shown in Fig. 4. The actual depth of indentation as measured is also plotted for easy comparison. Curve *A* shows the total downward travel of the piston. Curve *B* is the actual depth of indentation. The difference between any ordinate of curves *A* and *B* represents the compression of the different parts of the apparatus lying below the reference line. Any measurement of the depth of indentation must totally exclude these elastic compressions. It seems probable that Martens and Heyn may have encountered difficulty in doing this, because they state that when their curves depart from a straight line they sometimes curved upward and sometimes downward.

	Hardness Numeral in Kilograms per Square Mm. for							
	Copper		Mn. Steel		Silicon Steel		Cast Iron	
Load, Kilograms	1.2-cm. Sphere	1-cm. Sphere	1.2-cm. Sphere	1-cm. Sphere	1.2-cm. Sphere	1-cm. Sphere	1.2-cm. Sphere	1-cm. Sphere
1,000	86.5	83.4	179	177.5	215	214	136	137
2,000	....	....	183	181.5	222	219	138	139
3,000	....	....	187	185.6	225	225	140	144

TABLE 2. VALUES OF HARDNESS NUMERALS OBTAINED WITH SPHERES OF DIFFERENT DIAMETERS

	Copper				Cast Iron			
	Ludwik		Author		Ludwik		Author	
Load, Kilograms	*t*, Mm.	*H. N.*, Kg. per Sq. Mm.	*t*, Mm.	*H. N.*, Kg. per Sq. Mm.	*t*, Mm.	*H. N.*, Kg. per Sq. Mm.	*t*, Mm.	*H. N.*, Kg. Sq. Mm.
500	1.23	74.4	0.759	195.0	0.93	130	0.549	374
1,000	1.74	74.3	1.201	154.9	1.32	129	0.864	304
2,000	2.46	74.3	1.844	132.0	1.85	132	1.343	256
3,000	3.00	75.0	2.435	114.0	2.27	131	1.683	239

TABLE 3. COMPARISON OF THE RESULTS OF THE CONE HARDNESS TESTS

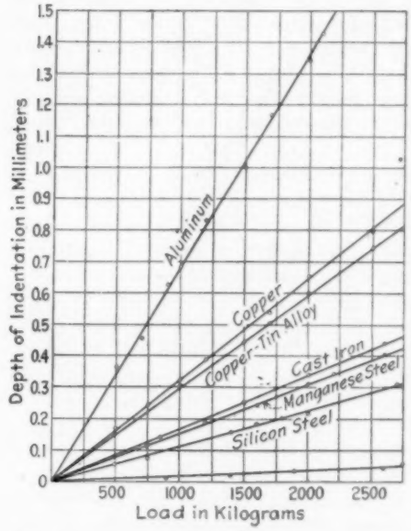


FIG. 3. RELATION BETWEEN LOAD AND DEPTH IN THE BRINELL TEST

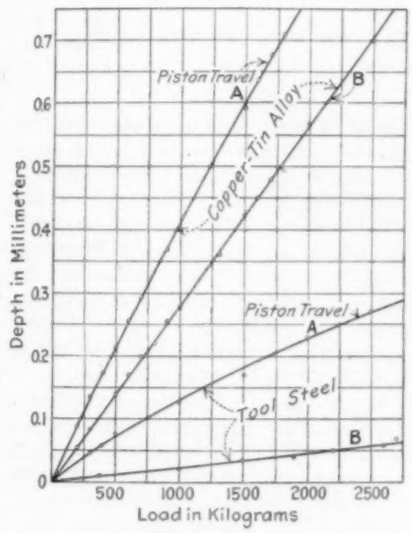


FIG. 4. LOAD DEPTH RELATIONS FOR TWO METALS

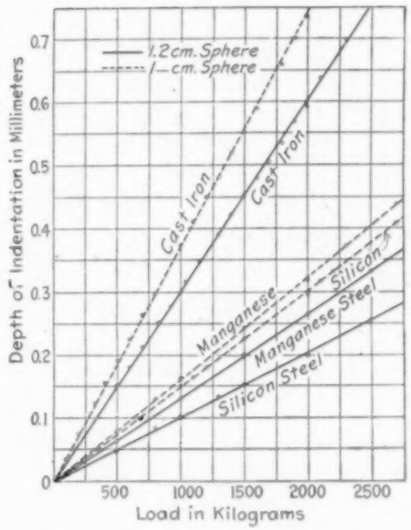


FIG. 5. LOAD DEPTH RELATIONS FOR SPHERES OF DIFFERENT DIAMETERS

ELASTIC DEFORMATION OF THE SPHERE

The hardness numeral as ordinarily determined is a function of the size of the sphere. If the sphere is elastically deformed under pressure, the hardness numeral will also be a function of the temper or hardness of the sphere.

Measurements of the depth and diameter of indentation of several metals a sphere of 5 centimeters (2 inches) radius vary considerably with the load and the metal tested.

It may be seen from analytical considerations that the amount will vary considerably for different metals even at the same pressures. For metals in which the metal flows up above the original surface, forming a ridge about the sphere, the radius of curvature of the sphere cannot be calculated in the above manner.

The calculation of the hardness numeral is important, since uniformity of results in hardness testing depends upon the method employed.

Of the three methods mentioned that of Brinell is always in error because the radius of the sphere is not equal to the radius of curvature of the indentation.

Meyer has shown that his method is open to the objection that some metals have exceeded their maximum hardness when subjected to 3000 kilograms (6600 pounds) pressure and others have not yet attained it.

The linear relation between load and depth of indentation suggests at once as the measure of the hardness, that load which is required to produce an indentation of 0.1 millimeter (0.004 inch) in depth. The simplicity of this method recommends it, but it is an evident departure from determining the resistance to indentation.

In order to conform to our definition of hardness the hardness numeral is also calculated by dividing the entire pressure by the area of the indentation which is

$$H.N. = \frac{P}{2\pi tR} \qquad (1)$$

Where

P is the applied pressure,

t is the depth of indentation, and

R' is the radius of curvature of the indentation.

If we substitute in Equation (1) the value $P = at$, the mean pressure or hardness numeral becomes

$$H.N. = \frac{C}{R}. \qquad (2)$$

Since the product of hardness numeral and radius of curvature is a constant for a sphere 1 centimeter (0.4 inch) in diameter, some measurements were made with a sphere 1.2 centimeters (0.48 inch) in diameter. The results, plotted in Fig. 5, show a linear relation between load and depth of indentation. The measured depths of indentation for the same metals obtained with the 1-centimeter sphere are plotted in Fig. 5 for easy comparison. These curves show that the depth of indentation is smaller for the larger sphere, but that the differences in depth are dependent on the metal under test.

The calculated values of the hardness numeral for the 1.2 centimeter (0.48 inch) sphere are given in Table II, and show a good agreement with the values obtained for the 1-centimeter (0.4 inch) sphere. Whether the product of hardness and diameter of indentation is a constant for all sizes of sphere, is a subject for further investigation. The hardness numeral suggested by Meyers is

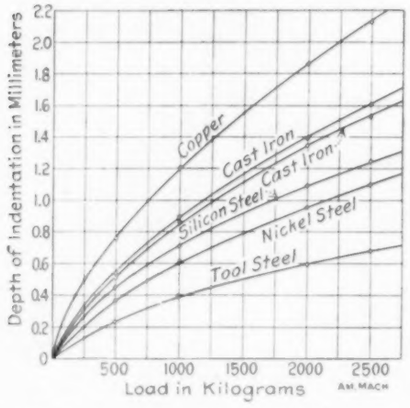


FIG. 6. RELATION BETWEEN LOAD AND DEPTH IN THE CONE TEST

$$H.N. = \frac{P}{\frac{\pi d^2}{4}}. \qquad (3)$$

Metal	Depth of indentation of Lead Disks in Mm. for Circular Cone Anvils of		
	120°	90°	60°
Cu.-Sn. alloy, No. 1.	3.26	3.14	2.99
Cu.-Sn. alloy, No. 2.	3.18	3.23	3.06
Cu'-Sn. alloy, No. 3.	3.20	3.35	3.04
Copper, No. 4.....	3.18	3.17	2.95

TABLE 4. RESULTS OBTAINED WITH DIFFERENT CONES IN THE BALLANTINE TEST

The other hardness numeral is

$$H.N. = \frac{P}{2\pi t R'}. \qquad (4)$$

Substitute in 4 the value of R' expressed in terms t and d and it becomes

$$H.N. = \frac{P}{\pi\left(\frac{d^2}{4} + t^2\right)}. \qquad (5)$$

If we compare equation (3) with (5) it becomes apparent that when the load and consequently the depth of indentation is small the values of hardness are practically the same for both methods.

For the higher values of the load and depth of indentation the values of hardness obtained by equation (3) are appreciably higher than those obtained by equation (5). The hardness numeral when calculated according to Meyers' suggestion therefore shows a greater variation with load than when it is calculated upon the actual area of the spherical indentation.

THE CONE TEST

Ludwik seems to have been the first to propose and use a cone of 90 degrees angular opening for the measurement of hardness. Although the test is the same in principle as the sphere hardness test, he thought that the variations of the hardness numeral for different loads encountered in the sphere would be eliminated in the cone test, because the indentations made by a circular cone are geometrically similar.

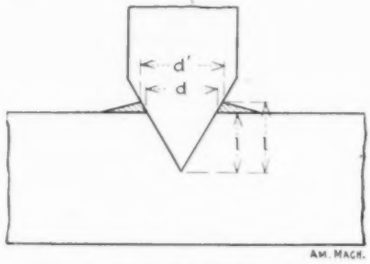


FIG. 7. CONE RIDGE FORMATION

In carrying out the cone test he measured the depth of indentation by means of an instrument, the action of which depends upon the downward motion of the piston to which it is attached. He calculates the hardness numeral on the basis of the entire applied pressure divided by the area of the conical indentation.

Following the same general method of procedure but using the micrometer microscope to measure the depth of indentation, radically different results were obtained, as plotted in Fig. 6. They show that the relation between load and depth of indentation is parabolic.

To compare the results obtained in this investigation with those given by Ludwik, the hardness numerals for the same loads are given in Table III. The results tabulated are typical of a large number of results on different metals.

If the results obtained by Ludwik were correct it would mean that the hardness numeral is independent of the load. But since the relation between depth of indentation and load is parabolic, according to the curves of Fig. 6, it is apparent that the hardness numeral decreases rapidly with increasing loads and becomes approximately constant only at the higher loads. Ludwik seems to have been aware of the errors made in the measurement of the depths of indentation, for he remarks in a foot note of his paper that a more careful adjustment of his measuring instrument would give results that would show the relation between load and depth of indentation to be parabolic. The relation between load and depth of indentation gives hardness numerals that make an arbitrary selection of load necessary but not sufficient to place metals in their correct position in a relative hardness scale.

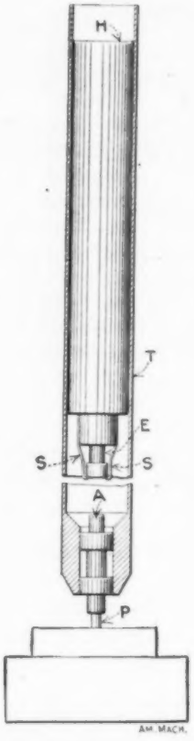


FIG. 8. BALLANTINE APPARATUS

The diameter of indentation might be measured if it were not for the fact that the metal, when under pressure, flows up above the original surface of the metal, forming a ridge about the cone as shown in Fig. 7.

In Fig. 7, d' represents the diameter of indentation that could be measured, while d is the diameter that should be measured.

In his work on the cone test Meyers states that the ridge of metal which forms about the cone supports part of the applied pressure and that the hardness numeral should be calculated on the basis of entire pressure divided by the projection of the conical indentation. He therefore calculates the area using d' as the diameter of indentation. In de-

termining the hardness in this way he overlooks the fact that the metal which forms the ridge has been forced from beneath the cone and has evidently lessened the resistance at that place. He also assumes that the ridge of metal offers as much resistance as if it were supported on all sides by unstressed metal.

Tests were carried out with cones of 60 degrees and 90 degrees opening on all of the metals used in the sphere test. The hardness numerals were calculated for the load of 3000 kilograms (6600 pounds) by dividing the entire pressure by the area of the conical indentation. The results are given in Table V. For two steels no results could be obtained because the points of the cones flattened under pressure. This is one of the limitations of all forms of hardness tests which employ a cone or punch.

The Shore Scleroscope

The scleroscope, briefly described, is an instrument consisting of a pointed hammer, which falls from a definite hight through a guiding glass tube upon the metal to be tested. The hight to which the hammer rebounds is the measure of the hardness and is read directly from a scale placed back of the glass tube. This scale is approximately 10 inches in hight and is arbitrarily divided into 140 equal parts. The hardness numeral is, therefore, not expressed in definite physical units. This is not a disadvantage if the scleroscope is accepted simply as a hardness measuring device, but it leaves much to be desired for investigational purposes.

In this method of measuring hardness the hammer makes a permanent indentation in the metal under test. An attempt was made, therefore, to determine the hardness as the resistance to indentation. In order to do this, it is necessary to measure either the diameter or the depth of indentation. Both of these quantities are extremely small and the former is inaccessible to all length-measuring devices. Some measurements of the diameter of indentation were made, but in general this is impracticable, because the bounding edge of the indentation is not circular. In the measurements referred to the greatest diameter of indentation was only 0.005 millimeter (0.0002 inch).

It would be entirely practical to determine the hardness numeral in the manner outlined if the hammer was enlarged and the hight of fall increased so that the diameter of indentation could be measured accurately.

In working with the scleroscope it was found that the hammer must be calibrated after a certain number of tests. For this purpose a piece of steel hardened to 100 scleroscope measurement must be used. The rebound for any given steel cannot be corrected by proportionate decrease or increase if the hammer gives a rebound either less or greater than 100 on the hardened steel. This shows that a slight change in the form of the hammer assigns the metal tested to a different position in the hardness scale. Although there are many things stated by the inventor concerning the theory of the instrument which cannot be accepted without experimental confirmation, they are left for discussion in the paper which deals with the relations of the physical properties of metals to hardness. The hardness numerals of all the metals tested are given in Table V.

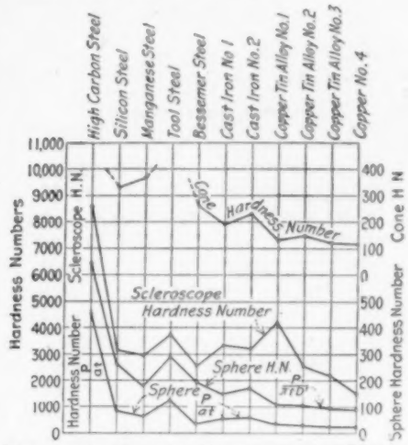


FIG. 9. GRAPHICAL COMPARISON OF HARDNESS NUMERALS

The machine has for its essential parts a fluted drill driven at constant speed; a table upon which the metal to be tested is placed and from which weights may be suspended for securing desired pressures; and an autographic attachment which traces a curve whose ordinates are some constant multiple of the depth of hole drilled and whose abscissas represent some constant multiple of the number of revolutions required to drill a given depth. The drill was sharpened on a special grinder, in such a manner that the rake and clearance of the drill was the same for every test.

The metal to be tested is securely clamped or otherwise held on the table. The weights needed to give the desired pressure are hung on the supports attached to the table. The point of the drill is allowed to drill into the metal before the diagram-tracing attachment is thrown into gear. If the drill dulls, it becomes apparent at once from the change of slope of the curve. The drill must then be taken out and sharpened.

Only a few of the metals tested by the other methods could be tested by the Bauer method. Some difficulty was encountered even in testing these. This was chiefly due to the fact that they had to be drilled at the same pressures in order to have a basis of comparison. It is a matter of common experience that the pressure applied to the drill and the speed at which it runs must be suited to the metal. Since the method depends upon the rate at which the metal is drilled for the measure of the hardness or workability, it is obvious that the results obtained for different metals are comparable only within very narrow limits.

Metal	Shore Scleroscope	Brinell Test $\frac{P}{\pi l D'}$	Brinell Test $\frac{P}{al}$	Cone Test 90°	Cone Test 60°	Bauer Drill Test	Ballantine Test
High carbon steel	86.1	641.0	4,550	.....	.....	....	3.23
Silicon steel	33.6	261.8	865	331.0	130.0	....	3.03
Manganese steel	29.5	179.0	641	368.0	124.0	....	3.25
Cast iron, No. 1	33.3	149.0	538	191.0	68.0	....	3.18
Cast iron, No. 2	32.9	172.3	590	231.0	79.2	2.29	3.23
Bessemer steel	26.6	188.0	428	260.0	76.5	....	3.31
Tool steel	37.8	289.0	1,230	.....	.....	....	3.29
Cu.-Sn. alloy, No. 1	42.4	110.0	360	130.0	50.1	0.73	3.14
Cu.-Sn. alloy, No. 2	25.5	105.0	323	149.2	54.1	1.04	3.23
Cu.-Sn. alloy, No. 3	22.1	94.7	289	122.0	48.8	1.24	3.35
Copper, No. 4	15.0	80.5	235	114.0	38.6	1.88	3.17

TABLE 5. HARDNESS NUMERALS OF DIFFERENT METALS FOR FIVE METHODS OF TEST

The Bauer Drill Test

The Bauer drill test differs essentially from the other hardness tests. It indicates the cutting hardness, and has for its object the determination of the workability of metals. The ease or difficulty with which a metal is worked in any machine tool is known to depend upon the toughness and the abrasive qualities as well as on the hardness. The drill test cannot, therefore, be strictly considered as being only a hardness test.

Since the drill test depends upon other qualities than hardness, it is evident that the results obtained should furnish instructive comparisons.

The machine which was used in this work is manufactured by William Keep and was designed for testing the hardness of cast iron.

The line traced by the autographic apparatus shows a linear relation between multiples of the depth of hole drilled and the revolutions required to drill it. The tangent of the angle which this line makes with the Y-axis is taken as the hardness numeral. For metal as hard as the steel drill the line traced is the X-axis. The hardness numeral of such a metal is, therefore, infinity. The results obtained are given in Table V. Each result is the mean of three separate determinations.

The Ballantine Hardness Test

Fig. 8 illustrates the essential parts of the instrument. The hammer H is fitted with a hardened cylindrical piece of steel E. The two springs S and S' are attached to the hammer and hold a leaden cylindrical disk 0.6 millimeter (0.024 inch) in depth and 1 millimeter (0.04 inch) in diameter in the position shown. The hammer is held in the upper part of the tube T by a trigger, not shown in the figure. The anvil A in the lower part of the tube is free to move vertically. The upper part of the anvil is a duplicate of the lower part of the hammer. The anvil terminates in a point P which rests upon the metal to be tested.

The instrument is supposed to operate and give results as follows: When the hammer is released it falls on the anvil, and the force of the blow drives the point P into the test piece. The lead disk is then indented a certain amount depending on the hardness of the metal. If the metal is hard, the disk will be indented more than if the metal is soft. The reciprocal of the depth of indentation of the lead disk is the hardness numeral.

Tests were made on ten different metals, but the indentations of the lead disk were practically the same for the hardest and softest metals.

The instrument as it comes from the manufacturers has an anvil point which is a circular cylinder slightly upset at the end. Thinking to increase the sensitiveness of the apparatus, anvil points were provided which were circular cones of 120, 90 and 60 degrees angular opening, respectively. The results obtained for three copper-tin alloys with these different points are given in Table IV. A comparison of these results shows that the modified cone points did not serve the expected purpose.

The next modification introduced was to reduce the area of the lower end of the hammer and the upper end of the anvil, in approximately the ratio of 2 to 3. That neither of these modifications served the intended purpose is shown by the results given in Table V.

For all of the metals tested the depth of indentation of the metal—not of the disk—was very small, amounting in the case of the softest metal to about 0.3 millimeter (0.012 inch). The energy of fall of the hammer is, therefore, practically a constant. This energy is spent in indenting the test piece and the leaden disk, and in heat. If a hard metal is tested the indentation of the metal is small, but the work done may be no less than that required to produce a larger indentation in a softer metal. If this is the case there remains only a constant fraction of the energy to do the work required to indent the leaden disk. This constant fraction of the total energy available can be a varying quantity for the different metals, only when the total energy of the falling hammer is itself a variable quantity for every metal. This would be the case only for widely varying depths of indentations of the metal.

Discussion of Results

The hardness numerals for all of the metals tested by the five different methods are given in Table V. To enable the reader to see at a glance how these methods compare, the results obtained by the scleroscope, the sphere and the cone method are represented graphically in Fig. 9. To obtain convenient numbers for graphical representation, the hardness numeral of the scleroscope is multiplied by 100, while that of the sphere, $\frac{P}{2\pi t R}$ and of the cone are unchanged. The sphere numeral $\frac{P}{t}$ is unchanged.

Strictly speaking, no comparison of these quantities can be made; but if the different methods measured the same quantity the lines connecting the points of hardness by one method would be parallel to the lines by another method. In these curves it is interesting to notice that the widest divergence between the Brinell and the Shore method occurs for those metals which contain elements whose presence is generally supposed to contribute toughness rather than hardness to a metal. Consider, for instance, the copper-tin alloys numbered 1, 2, 3 and 4. No. 1 is an alloy of 90 per cent. copper and 10 per cent. tin. By the scleroscope it shows a hardness greater than that of high-carbon steel. By the Brinell test it shows a hardness not much greater than that of ordinary commercially pure copper. No. 2, an alloy of 8 per cent. copper and 15 per cent. tin, is harder than bessemer steel or cast iron by the scleroscope. By the Brinell test it is only slightly softer than copper-tin alloy No. 1. By both the scleroscope and the Brinell method the hardness for the copper-tin alloy series is in the same direction. Alloy 1 is the hardest, with Nos. 2, 3 and 4 following in order. Compare this with the Bauer drill test hardness numerals and we see that the order is reversed. Alloy No. 1 drills the easiest and Nos. 2, 3 and 4 follow in the order named.

The cone and sphere test give results that are quite concordant throughout. For these two tests, a strict comparison can be made, for the results are expressed in the same units.

Eccentric Job on the Screw Machine

By S. N. Bacon

Eccentric parts are made on the automatic screw machine by many different methods, some of them with an eccentric chuck and others with a spring cutter operated by an eccentric collar on the spindle.

When a piece is formed off center, from square or rectangular stock, it gives a great amount of trouble and I wish to show the best method of forming these parts.

Fig. 1 shows a No. 0 Brown & Sharpe automatic screw-machine job which, if made concentric and out of round stock, would be very easy, that is, as regards the proper feeds and speeds.

The best results will be obtained in cutting four-cornered stock if a roughing tool is used as shown at A, Fig. 2. On this work the mistake of using one cutter with a fine feed is often made, and as the corners of the stock strike the cutter the chips seem to pack on its edge like soft lead. In using a roughing tool this does not occur and the finishing tool has only a light cut to take until the depth of the corners is cut, and from this point the cutter works the same as if the stock were round.

B in Fig. 2 is the cutoff tool, which also forms the round end. It will be noticed that the roughing cutter A does not touch either the front or rear end of the piece. The operations for this piece are as follows:

SPINDLE SPEED, 543 R.P.M.

Order of Operations	Revolutions	Hundredths
Feed stock to stop	12	3
Rough form 0.184-inch travel at 0.001-inch feed	184	46
Cut off and finish form 0.303-inch travel at 0.0015-inch feed	198	50
Clearance	4	1
Total number of revolutions for one piece	398	100

The time required for one piece is 44 seconds and the gross product is 818 in 10 hours; net product, 725.

The gears used are a 30-tooth on the driving shaft and a 44-tooth on the worm shaft. The maximum peripheral speed

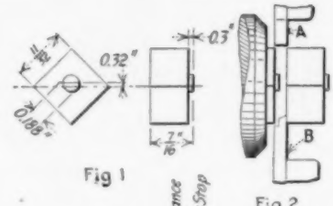


Fig 1

Fig.2

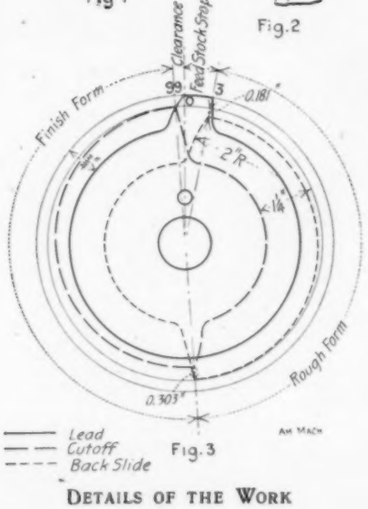


Fig.3

Details of the Work

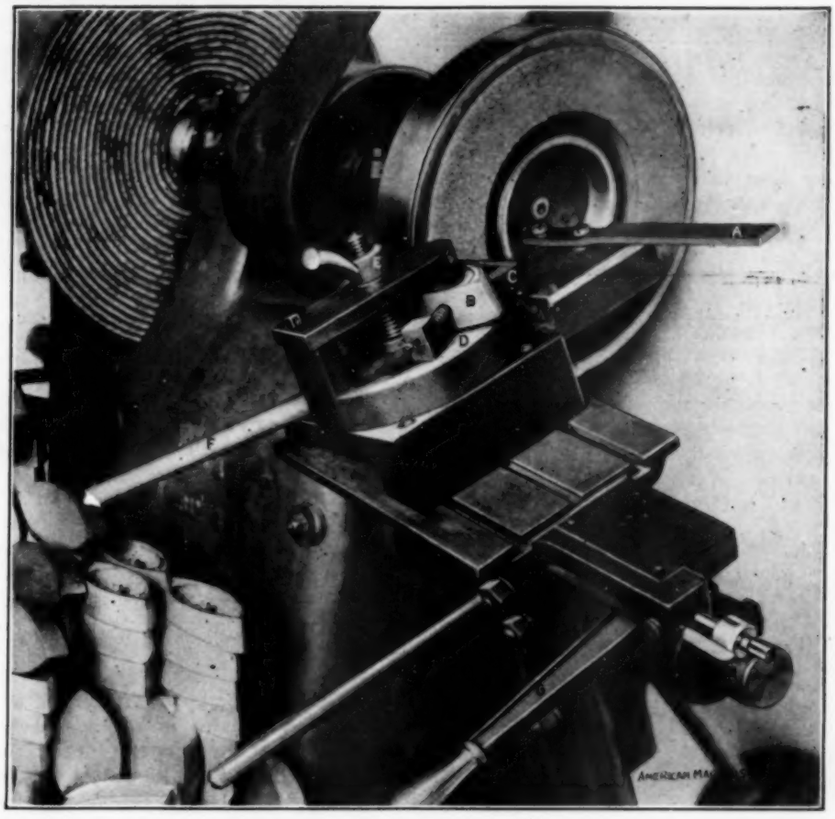
of stock is 77.68 feet per minute, figured from the extreme corner. The speed and the feeds given above are perfectly safe, on work of this kind.

The cams for this piece are shown in Fig. 3 and need little description, as they are very simple. The lead cam is a heavy line and the front-slide cam, or cutoff, is shown by a dashed line, while the dotted line shows the form or back-slide cam, which extends from 3 to 49 on the cam circle.

Grinding Sad Irons from the Rough

SPECIAL CORRESPONDENCE

The fixture shown herewith was used with a single-spindle Besly grinder on the lever-feed table, for grinding the edges of sad irons where the edges were true circles.



GRINDING SAD IRON FROM THE ROUGH

The fixture has a locating device, so the work is mechanically chucked in just the position where the edge will clean up to a true circle with the removal of the minimum amount of stock.

Ordinary double-point sad irons, as shown, 7 inches long, 1⅝ inches high, are finished on the edge from the rough casting at the rate of 30 irons per hour per man. The rough casting is laid on work holder. A sliding member operated by the lever shown at *A*, engages the rough edge of the iron *B*, on two contact points *C*, and forces the iron back against two elastic centering plungers *D*, to a stop, not shown. In that position the iron is rigidly clamped in place by means of handle nut *E*, shown on top of the fixture.

The handle *F* at the left swings the workholder around to the grinding wheel and swivels the work across the grinding wheel, while the lever-feed table provides the feeding pressure by means of the lever *G*, shown at bottom of the cut.

The adjustable micrometer stop screw *H* on the lever-feed table regulates radius of the circle generated. While this is not important on sad irons, cylindrical work is, in other lines, being ground on Besly grinders by the above described method, and the radius maintained within a few thousandths of an inch. The above described method leaves the edge of the sad iron a true conic section, which results in a very exact and neat looking iron.

What is said to be the first piece of machinery of any kind ever made in the Northwest (Idaho, Washington, Oregon), to supply an eastern demand, is a cement pipe-making machine, weighing nine tons, the product of the Baxter Foundry, Boise, Ida., and shipped to Kansas City. The machine is based on the molding principle, and is capable of forming pipe from 4 to 24 inches. This transaction is looked upon by some as marking an era in development in the northwest.

Design for an Exacting Customer

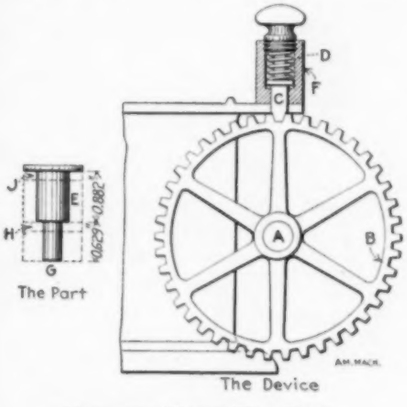
BY E. G. STOVER

In a shop where I once worked, we had a job of making some special machines, a part of which is shown in the accompanying figure.

The customer's drawings for all longitudinal measurements called for inches and thousandths of an inch, and the thousandths were not some equivalent of 64ths, 32nds, 16ths or 8ths of an inch, or any particular graduation found on any commercial steel rule. He was obstinate and would not allow any approximation. Having no instruments with which to take measurements, I devised the following scheme.

On the lead screw *A*, which in this case had eight threads to the inch, I placed a 125-tooth gear in place of the regular change gear. This gear was held in its proper position by the lock pin *C*, which was contained in the sleeve *F*, which in turn was attached to the ledge of the bed.

The lock pin *C* is held between the teeth of the gear by the spring *D*. To meet the requirements, the end of the piece was squared at *G*. A parting tool was next set in the tool post, and the side of the tool brought against the surface *G*. The lock pin *C* was withdrawn from the gear *B*, and the gear was given five complete revolutions and four teeth on the sixth revolution, which brought the side of the tool at the required position, the lead-screw nut having been previously engaged with the lead screw. A groove was then cut, as at *H*, to the required diameter.



HOW THE WORK WAS DONE

To obtain the next dimension, the lock pin *C* was withdrawn from gear *B* and the gear given seven complete revolutions and five teeth on the eighth, cutting a groove as at *J* to the required diameter. The remainder of the bearings were turned to the diameter of the grooves.

It is needless to say, that when the machine was assembled, it was discovered that making these fine measurements was useless.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

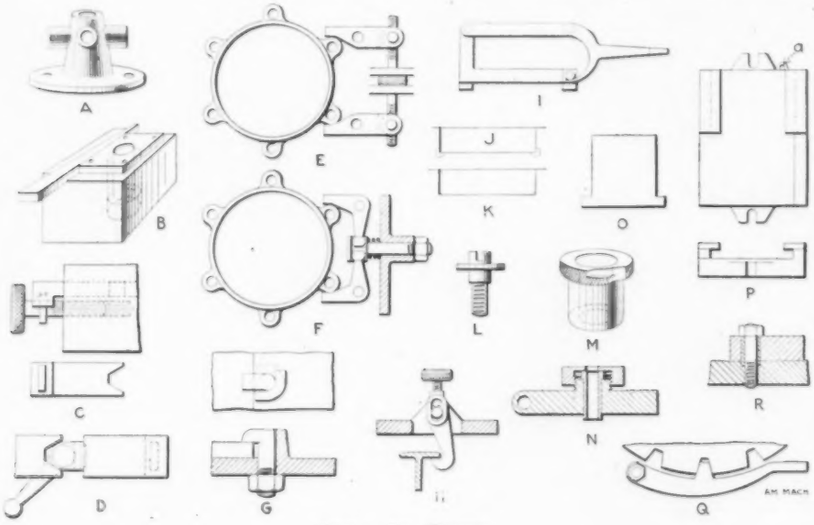
A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Drill Jig Design

Many of the following points may be found useful to the draftsman who is designing drill jigs. They are all practical and largely used in the shops at the present time.

Perhaps the first thing to decide when designing a jig is the locating points. When doing this the ultimate result required must not be lost sight of; that is to say, that the position of the drilled holes may have to be correct to a portion of the job other than that in which they are situated.

For example, suppose *A*, in the accompanying figure, represents the piece, which is, first of all, machined on the base, then drilled, and from this drilling located on a turntable in a turret lathe for boring the holes in the bosses. The point is this: that although it is desired to have the holes in a position relative to the base, it is more essential to have them relative to the bosses, so that in the boring the bored holes will be in the center of their bosses. Another thing to be careful of is that the points chosen do not come on the "fin" or "flush" of a drop forging or the side of a casting from which it is poured.



DRILL JIG PARTS

To keep the piece up against its locating points—whenever possible—the force applied should pass directly through these points or through a line joining them, otherwise the piece is liable to rock.

It will be found that three fixed locating points for a surface is ideal, as a piece that is not perfectly flat can never rest steadily on more than three. Naturally, care must be taken in the choice of the three points. I have found a fillister-head screw is the best means of location for most jobs. The screw is screwed firmly down to its head and its length decides the position of the piece. When worn, all that is required is a new screw. Another advantage in favor of this method is that for new sets of forgings or castings, the screw can be adjusted to suit the new conditions; for example, drop forgings may come in with a bigger "flash," which makes the whole piece wider; a shorter screw overcomes this trouble. Suppose some pieces have to be drilled, which are to act as covers and have a spigot or recess turned on them to locate them in position. If the flanged portion (in which the holes are to be drilled) of these covers have straight sides, whether three, four, five or many more, a wedge pushed along one side, with the spigot or recess located in the jig, proves the best means of locating the flange; see *B* in the figure.

On other forms of covers, the metal is increased round the bolt holes. Here too, in many cases, the wedge may be used, but in others it may be impossible, and then a sliding V will be found useful, as at *C*.

For levers, as shown at *D*, a sliding plate gives every satisfaction as a means of location, when the boss fits in a fixed V; see *D*. The arm of the lever is, of course, narrower than the boss. If the lever is a stamping, care must be taken to see that the plates clear the "fin."

On large castings or drop forgings, the sliding plates prove scarcely delicate or strong enough. Two bell-crank levers, actuated by a longitudinally fixed screw with a right-hand thread at one end and a left-hand at the other, are effective in giving a mean of any error that may arise. *E* illustrates this means of locating; *F* is an alternative method.

The use of nurled-head screws, thumb screws, etc., as a means of holding work up to their stops, is too well known to need describing. Swing bolts with wing nuts and slip washers (which should always be secured to the jig) are also well known as clamping devices. Hook bolts are not altogether satisfactory, but if well supported give good results. One method of procuring these is shown at *G*.

Another form of hook bolt *H* was used to hold a bush plate down on the top of a crank case. A rapid and useful device for holding down the leaf of a small box jig is shown at *I*, which illustrates a section of such a jig.

After the locating points are decided on, the number of bases the jig must have must be seen to. Care must be taken that no part of the jig projects beyond these bases and that none of the holes to be drilled overhangs the base, to any great extent.

The following points must not be overlooked:

1. Whenever possible drill a job against its base, so that there is no likelihood of bending it, and not by bolting it up under the jig, leaving the clamps and bolts to withstand the pressure of the drills.

2. That all the locating points and bushes are easily visible.

3. That there is ample clearance for chips.

4. That the jig can readily be washed out; i.e., avoid corners as far as possible. "Dirt grooves" as shown at *J* often simply harbor the dirt; a chamfer on the leaf is preferable, as at *K*.

5. That the piece can be put in and taken out easily and quickly.

Having decided on the bases it must be seen to what limits the holes are required, whether drilled or reamed and whether the piece has to be faced round the holes. If either of the latter a slip bush will be necessary. This slip bush should be located in a fixed bush in the jig. All bushes should be of hardened cast steel. The best method of holding the slip bush is with a screw, *L*.

The bush is shown at *M*. Screwed bushes, which are sometimes used for holding down purposes, are not advisable; they are not good even when designed with a long plain bearing; the best of them wear badly.

On a small leaf jig, *N* shows a method that may be employed. Where large holes are to be drilled the bushes must be well supported. For cored holes a three- of four-lipped drill gives every satisfaction.

Jigs for Multiple Spindle Drill

When designing jigs for the multiple spindle machines the shortest distance that is obtainable between the drill spindles, their range and number, the largest drill that can be used, and the greatest hight of work the machine will take, must be noted. The number of holes in the piece and their distance apart must be carefully noted and then the arranging of the drilling decided upon.

Suppose that the piece is a simple cover with a few holes, such as shown at *B;* then the drilling is an easy matter. Jigs of this nature should be designed with a base, shown at *O*. This base is made a sliding fit in a slide *P*.

The slide is bolted to the machine table and has a pin *a* which acts as a stop for the jig. The slide is made about twice the length of the jig. The jig is slipped on at the open end and pushed up against the slide on the right, and is then slid up to the stop. In this way it is brought to exactly the same place every time, which saves the operator's "fishing" for his bushes and making small drill marks all over the jig. But the great advantage gained is that the slide takes all the twisting action due to the drilling, and so saves the drill spindles, giving them a longer life and saving the repair department from constantly having them under their care.

For large jigs this method is impracticable, but two angle irons bolted to the machine for the jig to slide between forms a good substitute. The best locating finger for an indexing jig I find is as shown at *Q*.

The pivot *R* for this finger is made by passing a "barrel" over a standard stud, the barrel standing 0.010 above the finger and recessed into the jig body. The center line of the pivot should pass through the half-way line on the tongue, as shown. The tongue should be tapered to allow for wear. The spring box acts as a stop for the finger. A shouldered bolt as a pivot never gives entire satisfaction, as by one means or another it usually works loose.

I. A. Moon.

Alvaston Derby, England.

Cutting a Screw of Variable Pitch

Some time ago I had occasion to design a machine that required a screw of a variable pitch. To cut it was somewhat of a problem as it had to be done as economically as possible, it being for an experiment which might never be required again. The screw to start with was two pitch, or ½ inch center to center at one end, and $\frac{1}{16}$ inch center to center at the other end for several turns of the screw. Between the two pitches the screw decreased in pitch by the difference between those at the ends.

Fig. 1. The Work; Screw of Decreasing Pitch

To accomplish this, the lathe was geared up to cut the large pitch first, and the lead screw was allowed to play endwise in its bearings, connected to and controlled by a cam which revolved less than one revolution while the screw to be cut was making the complete number of turns. As the lead screw advanced the carriage, the cam retarded it the amount of the difference between the two pitches. At the first part, for several turns the screw was cut as geared up, then it was retarded $\frac{1}{16}$ of an inch while making the required number of turns to reach the point where the pitch was to be $\frac{1}{8}$ inch; then the carriage was retarded $\frac{1}{16}$ of an inch every revolution of the screw, making three distinct pitches with one lead screw.

The cam was figured out by the number of divisions the compound gearing gave it, driven by the main spindle. Each division represented one turn of the screw to be cut. In this case it took 44.88 turns of the spindle to make one turn of the cam; the screw to be cut had 28 turns, therefore the cam would have to make $\frac{28}{44.88}$ parts of a revolution. However, the cam was laid out for $\frac{31}{44.88}$ turns, to leave time for the tool to be withdrawn. At the start there was plenty of time as the cam was at a dwell and the lead screw was doing all of the work.

Of course there is a limit to the length of screw that can be cut in this way, but it depends a great deal upon the pitch and the diameter of cam that can be used. By gearing down through compound worm gearing any number of divisions can be gotten; but if too fine it would not leave time enough for the cam to work easily, as the angle of action on the cam would be too great.

The accompanying line cuts will show the arrangement of the gearing and cam, as well as the layout of the screw to be cut.

New York City. Charles F. Smith.

Special Tools for the Air Drill

I invented and made some special tools at the Canadian Pacific Railway Angus shops, Montreal, and by their means effected a great saving in time and labor.

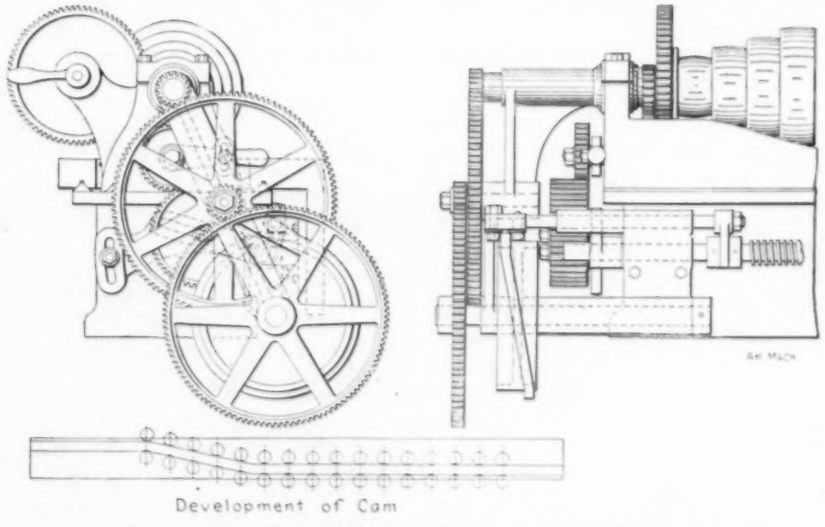


Fig. 2. Arrangement of Camming the Lathe Lead Screw to Cut Varying Pitch Threads

At the time of their production, the Canadian Pacific Railway was engaged in the work of replugging the numerous gas tanks carried underneath its passenger cars. Each tank contained from

fifty to seventy-five ⅜-inch holes, which were formerly filled with lead as a preventive of explosion in case of fire. On the introduction of a new nonexplosive gas, the lead-plugged holes in the tank had to be replaced with brass plugs.

This represented no small amount of work, as there was a large number of cars with two tanks each.

The lead was first drilled out of each hole by means of the air drill, and tapped with a ¼-inch pipe tap. The plugs, made of 7/16-inch diameter brass bar cut off 1 inch long and threaded one-half their length, were next inserted in the holes by one man, while the second followed with an air drill and the chuck, Fig. 1.

In Fig. 1, *A* is the body proper, and *B* the shank with a proextension at the side, into which is fastened the post *D*. The eccentric gripping piece *C* is made of cast steel and hardened. Pin *H* holds the shank *B* to the body of the chuck by engaging the groove cut on the proextension of the body *A*.

The spring *G*, being fastened at one end to the shank *B*, and at the other to the post on the body of the chuck, causes the shank *B* to be carried to the left and the eccentric gripping piece *C* with it by means of the post *D*. Thus the chuck is always held open to receive the end of the brass plug *M*. In operation, the shank *B* is carried to the right, thus causing the eccentric gripper to grip the end of the plug inserted in the chuck. The hardened-steel piece *F* also assists in gripping and holding the work.

After the plugs are screwed in, the projecting end is cut off by means of the tool shown in Fig. 2. This is accomplished by a downward pressure on the air drill as the tool is driven by it revolves around the end of the brass plug. The cutter held in the sliding bar *B* is forced against the plug until the corner of the cutter reaches the center, when the plug is cut off flush with the tanks. The lever *D* serves to engage the shank *C* with sliding bar *B*. Thus a vertical reciprocating movement of the shank *C* causes a horizontal reciprocating movement in sliding bar *B*.

The spring *J* serves to hold the tool open to receive the work. The pin *I* holds the shank *C* on the body of the chuck and also prevents it from turning on its pivot.

Two men turned out 16 tanks a day with these tools, whereas four men without the tools turned out only four tanks per day.

WILLIAM D. WHITE.

Montreal, Canada.

A Point in Worm Wheel Design

It frequently happens, in the design of worm gearing, that the designer has to make use of a speed reduction of 30 to 1, or even greater.

To do this with a worm having only a single thread, means that the worm wheel will have only 30 teeth, or under, depending on the reduction.

If this worm wheel is hobbed by the usual process, we have the teeth formed as shown in Fig. 1. This tooth, it will be noticed, is weak at the root, and for a heavily loaded worm would prove unsatisfactory. This state of things can be remedied if the pitch diameter be slightly enlarged, the result being a tooth of the form shown in Fig. 2.

While I am aware that a great many engineers are against the use of this enlargement in the pitch diameter, I have used it successfully wherever I had worm wheels of 30 teeth or under, and the loss of efficiency, if any, was fully compensated for by the increased factor of safety of the tooth section.

I give the formula used to obtain only sufficient enlargement of the pitch diameter to insure that there will be no undercutting.

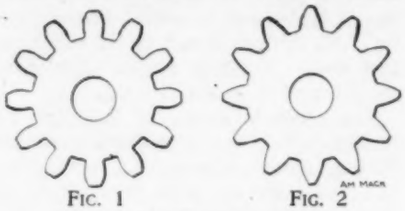


FIG. 1 FIG. 2

DIAGRAM OF TEETH OF WORMS

Enlarged pitch diameter = 0.937 *pitch diameter* + 0.63662 *circular pitch.*

The hight of the tooth above the pitch line remains the same as for an ordinary worm wheel, as does also the depth below the pitch line.

Niagara Falls, N. Y. J. WHYTE.

The machine shop on board the U.S.S. "Georgia" is situated in probably the hottest part of the ship. It is directly underneath the evaporator room, just abaft the after fire rooms, and just forward of the upper engine rooms. It has been considerably improved in habitability by the transfer of the four steam air compressors to the engine room. There are in the machine shop the following tools: One large gap lathe, capable of swinging 54 inches in the gap; one 14-inch Flather engine lathe; one 16-inch by 12-foot Hendy-Norton tool-room lathe; one No. 14½ Becker-Brainard universal miller with vertical attachment; one 18-inch shaper; one 28-inch and one 12-inch driller.

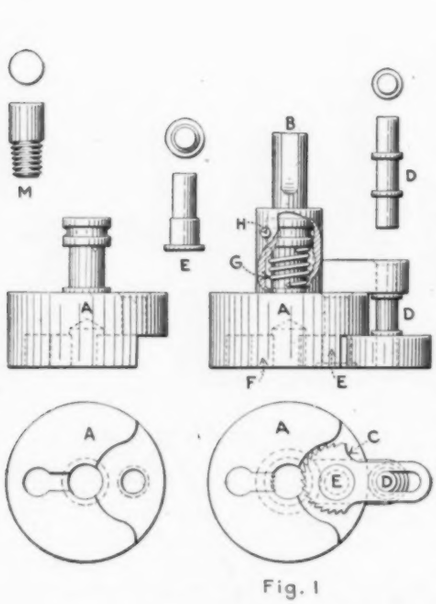


Fig. 1

THE CHUCK FOR DRILLING

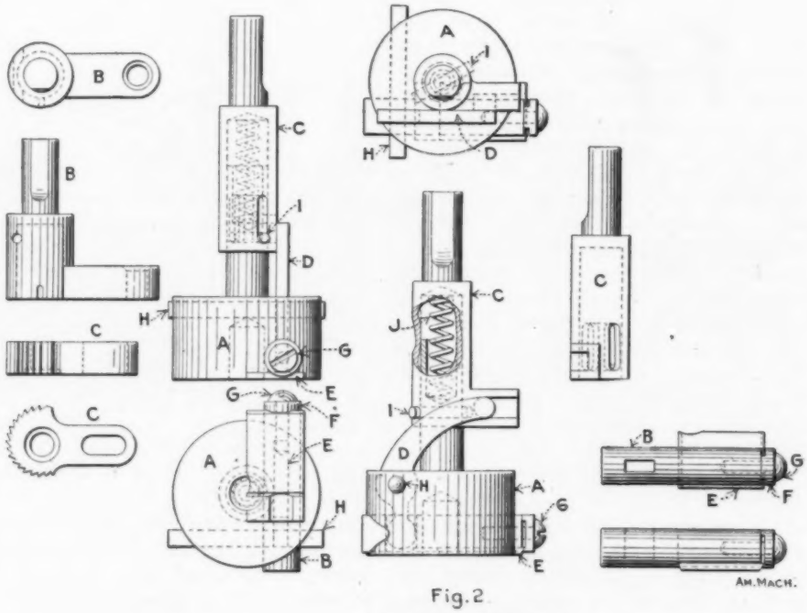


Fig. 2

THE CUTTING-OFF TOOL

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Twisting Lathe Beds into Shape

In the article which appeared at page 459, by John R. Godfrey, entitled, "Twisting Lathe Beds into Shape," Mr. Godfrey states that trade-school boys learn one thing wrong, and learn it wrong from lathe-building shops.

Mr. Godfrey is entirely mistaken in his statement that the men he describes have been taught from lathe manufacturers. I wish to state that no reputable lathe manufacturer ever drives wedges or shims under the legs of the lathes to abnormally force a correct alinement, nor does he use an indicator and test bar to show him which wedge to drive and how much. Any lathe bed, no matter how heavily or scientifically designed, will twist out of shape if placed on a floor or foundation that is not level, and the only thing a manufacturer can do, and what he does do, is to bring the bed back to the original true condition it was in when it left the planer. He does this by means of shims placed under the legs, and uses an accurate and sensitive level placed across the bed to guide him in placing the shims; the bed being correctly set when the level shows the same when placed on opposite ends of the bed. The bed is then alined and erected in this condition, and if the customer levels his lathe the same way, no trouble will arise. This operation is very simple, easy and mechanically correct.

Mr. Godfrey is right in his contention that these wedges must be driven just right, as this must be done very accurately. I might say in this connection that the levels millwrights and others ordinarily use who set lathes in position, are very inefficient, most of them using an ordinary carpenter's level, which is not sensitive enough, requiring a 64th or 32d inch to be placed under one end before the bubble moves perceptibly. Most lathe manufacturers use a sensitive and accurate level, the bubble of which will move about ⅛ inch, if a piece of tissue paper measuring 0.001 of an inch is placed under one end. Few people realize that an error of a few thousandths of an inch in leveling the bed, will result in work of an inferior quality being turned from the machine. Placing jack screws under each leg, and leveling the lathe while it is being erected from a surface or floor plate, will be of no practical value, as no foundation or floor as ordinarily built, is made level to a sufficient degree of accuracy for a job of this kind. Jack screws would not even test the level of a foundation, as the bed would conform to a certain extent to the level of the floor or foundation. Jack screws could be used to level the lathe, but plates would afterward have to be placed under the legs, so it would be much better to use solid packing without screws in the beginning.

This leveling proposition is rather a sore spot with most of the lathe manufacturers, as nearly all of the complaints from customers that lathes do not bore, turn or face straight, arise from the fact that the customer has not leveled his bed properly, or as Mr. Godfrey has it, "Has not twisted it into shape."

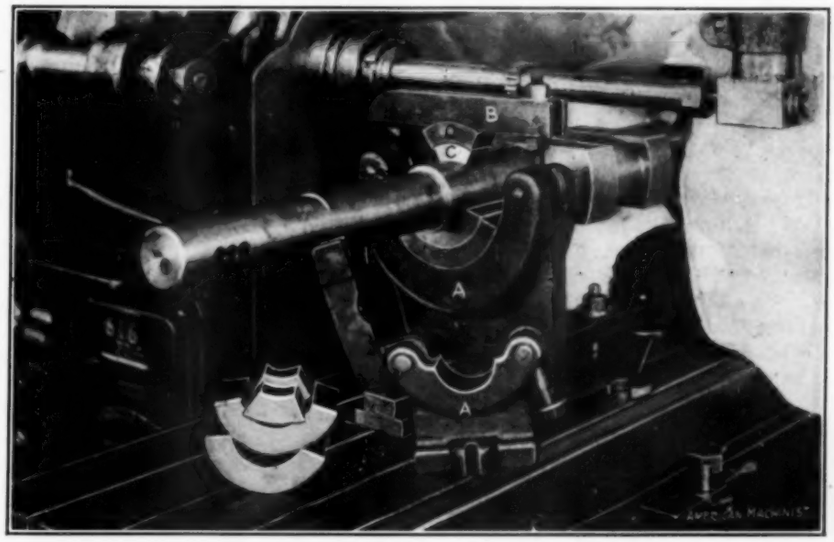
It would be ridiculous for one to expect to place a lathe on a foundation or floor and pay no attention to the level. The longer the lathe bed is, the more apt is it to become twisted, and consequently it must be more carefully leveled. The 3-point support would do away with this trouble on short beds, but it has many objectionable features, especially on a long machine. As a general rule, machines which are self contained, that is, square in construction, with the weight evenly distributed over the whole base, are generally made with a 3-point bearing on the floor, and generally require no leveling. Some of the machine tools which do not absolutely need to be leveled are milling machines, small grinding machines, gear-cutting machines, shapers, etc., but even with these, better results can be obtained if they are carefully leveled. The machines which it is absolutely necessary to level accurately are planers, lathes, large and long grinding machines and others of a similar nature.

JOHN A. LE BLOND.

Supt. R. K. Le Blond Machine Tool Company, Cincinnati, Ohio.

Split Bushings for Cylindrical V-Blocks

On page 204 under the heading, "Bearings for Grinding Rolls on their own Journals," is shown the way these bearings or bushings are made in the shops of the Waterbury Farrel Foundry Company, Waterbury, Conn. The halftone herewith, reproduced from a photograph taken in the same shops, shows the use of these bushings on the miller where they are used in conjunction with the members *A* and take the place of V-blocks. Two of the members *A* are used. They are bored to fit the outsides of the bushings which are made in sets. The bushings can be used in multiple as in the case shown, that is one set of bushings inside another set. The hinged cap *B* of the member *A* is drilled and counterbored in the center for a fillister-head screw and the short pieces *C* are tapped to receive the screw, so that when the cap *B* is lifted, while changing work, the parts *C* will be lifted with the cap *B*. This style of cylindrical V-block is very satisfactory, giv-



SPLIT BUSHINGS FOR CYLINDRICAL V-BLOCKS

ing as it does considerable bearing surface for the work, it does not wear in ridges as does the regular V-block.

New York. E. A. DIXIE.

The Other Fellow's Honesty

The article by John R. Godfrey on page 152 calls to my mind some similar experiences of my own regarding the other fellow's honesty.

One incident happened several years ago, while I was connected with an Eastern firm manufacturing paper-mill machinery. A mill located in the Middle West asked us for drawings and quotations on an iron end vat for a straw-board machine, giving us complete data covering their requirements. We accordingly made up a drawing and submitted a bid. In a few days the print was returned with several changes indicated and a new bid requested. The changes were duly made and a new bid submitted but again it came back with still more changes requested. A third drawing was made and sent and nothing more was heard for some time. As they had given us to understand they would order the vat as soon as the drawings met their requirements we wrote them after a time inquiring what disposition had been made of the matter and were briefly informed that the order had been placed elsewhere. Some time later this same firm was in the market for a complete straw-board machine. As this was a large job, we sent a salesman out there and the first thing he saw on entering the mill was our vat in operation. Upon making inquiry he found that the vat had been built at the mill. They had simply worked us for a complete drawing of our type of vat to meet their requirements and then had built it themselves.

Another case was that of one of our great railroad systems purchasing some wrecking cranes from a well known firm of whom they required a complete set of detail drawings, supposedly for their convenience in making or ordering repair parts. They later on built some cranes from these drawings in their own shops. In this case, however, they were justly punished as the cost was considerably in excess of the amount for which they could have been purchased.

There is little question that the above are cases of downright dishonesty, obtaining valuable information under false pretenses. The same reasoning, however, would apply to ourselves when we send for a catalog for the purpose of securing the information it contains, having no intention of purchasing the article it advertises. Yet this is a common occurrence and is not generally considered dishonest. Thus the line between honesty and dishonesty in these matters is a fine one and depends largely upon the point of view. If the other fellow "puts one over" on us we are apt to consider it dishonest, but what if the boot is on the other foot?

Moline, Ill. H. J. MASTENBROOK.

Graduating a Board for Angles

On page 1129, Volume 34, "Etches" explains a method of setting the angle of the T-square blade by marking a protractor on the T-square head and states that it is sufficiently accurate for all ordinary work. The following method is much more satisfactory.

The method is clearly shown by Fig. 1. The T-square is assumed to be of the single-shifting or swiveling-head type to prevent complication in the illustration. A mark is made at *A* on the T-square and a similar mark *B* to coincide with it on the board. Now, when any setting of angles is to be made the T-square must always be in the same relation to the board. With this arrangement, the greatest possible protractor is used which results, of course, in the greatest possible accuracy.

As some people overlook the method of obtaining the length of blade of a "shifting-head" T-square and, unfortunately, confuse it with the ordinary type, perhaps it will not be out of place here to mention one method of determining this. See that the scale of the T-square touches the top corner of the paper when in the position shown by the dotted line in Fig. 1; you will find that it will answer most of the purposes required of it and that it will be of a very convenient length to use. The T-square head shown by Fig. 2 answers the purpose most satisfactorily.

CLARENCE BOLTON.

Lancashire, England.

Acoustic Signal Apparatus for Airships

Engineer Philipp Lens, of Gross-Lichterfelde, Germany, has recently constructed a device to show the rise or fall of an airship. The signal apparatus consists of a rectangular wicker backet, in which a wind wheel is placed vertically. By means of a lever connected with the axis of the wind wheel, two sounding mechanisms are set in motion as soon as the little wheel revolves. The bottom and top of the complete instrument are provided with openings so that the air can enter either way. As soon as the balloon changes its altitude, an air current flows into the signaling instrument, setting the wind wheel in motion, and with it the sounding mechanism. In order to render the device useful for motor airships, the top and bottom of it are provided with a wire gauze as shields against the vertical current caused by the propeller.

Prompt medical attention by experienced doctors with special accident training is of immeasurable value in prevention of simulation and imaginary ailments. Up to the present time, German prevention experts have concentrated their energy upon serious accidents, but the number of light accidents is increasing rapidly. However, the growth in the number of light accidents and the serious parts which simulation and imagination play in this growth, result in concentrated effort of German experts toward reduction of light accidents.

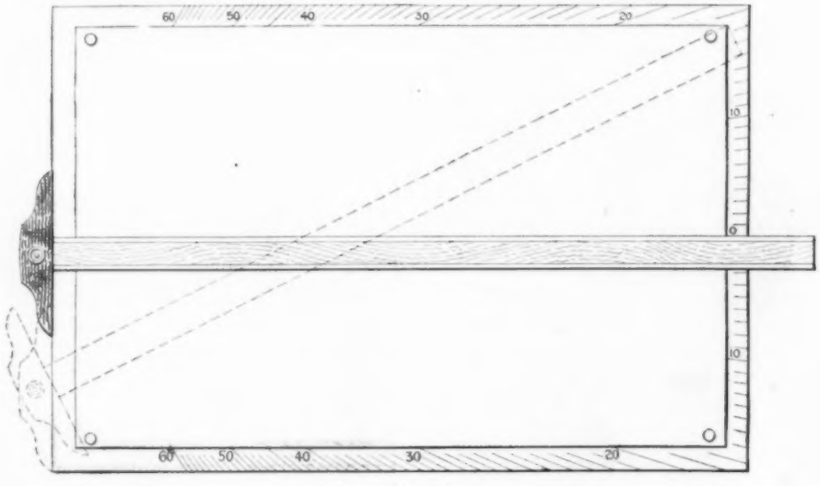


Fig. 1

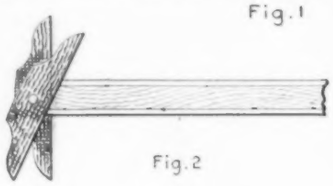


Fig. 2

A GOOD T-SQUARE HEAD

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OUTLINE OF TOPICS, PAGE 225

American Machinist

Manufacture in the Northwest

While it is a matter of common knowledge that the Eastern States, and what is generally known as the Middle West, are no longer the sole producers of machinery in this country, there are probably few people in the East who realize to what an extent the manufacture of machinery is being developed in the sections bordering upon and immediately to the west of the upper Mississippi river. Firms in the cities of Minneapolis and St. Paul, for example, have for many years built steam and gas engines ranging up to very large sizes, agricultural implements, traction engines, sawmill machinery, hoisting and conveying apparatus, steam fire engines, and a great variety of other machines; and more recently gasolene tractors in large numbers and automobile fire engines are being constructed.

One of the latest industries to be developed in the section referred to is automobile manufacture, and there is at least one large shop in Minneapolis building both pleasure vehicles and auto trucks.

Iowa is gradually engaging in the production of implements of various kinds in different towns scattered through the State, and the shops in this industry, together with the older and better known establishments in such places as Dubuque, Davenport and vicinity must ultimately give the State considerable prominence in the manufacturing field.

Further north, too, the frontier of machine building is being pushed slowly westward, and when one visits a town like Fargo, N. D., from which point immense quantities of agricultural machinery are distributed through the great Northwest, he cannot help feeling that eventually a good deal of apparatus of this nature will be built nearer the fields where it is utilized.

The articles now appearing in this journal descriptive of various shops in Minnesota, will, it is hoped, attract some attention to machine-building operations in a section which comparatively few of us have viewed as being of such importance in connection with the manufacturing industries of this country.

The Sense of Touch in the Machine Shop

The sense of touch is commonly recognized as an essential factor in the satisfactory accomplishment of a large share of operations performed by the toolmaker. It is equally important in many lines of manufacture.

Notwithstanding the fact that, as the art of machine construction becomes more and more highly developed, a corresponding development of highly specialized automatic apparatus takes place, there continues to be a wide opportunity for the utilization of semi-automatic and hand-operated machinery, even in the most scientifically organized plants. And the field for tools of this nature necessarily broadens out very appreciably, when we consider their importance in the majority of shops, where operations are still carried on upon a scale which warrants the installation of only a limited amount of machinery of the automatic class. So, in spite of the general departure from the old hand processes of earlier times, the sense of touch remains today of considerable importance.

The faculty known as the sense of touch, that enables the operator of a hand-screw machine to follow by the "feel" of his lever, the cutting action of each of the tools as it is in turn run over the rotating stock, and to finish the cut with a definite pressure against the tool-slide stop, also serves as an accurate medium by which the operator of the hand miller may gage the action of the cutter under which he feeds his work. In these cases, as with certain other machines of the hand-operated type, the practiced workman can bring the tools to the work or the work to the cutter with a movement that is almost instantaneous and, throughout the extent of the cut a feed may be maintained that is limited only by the strength of the operator or by what his sense of touch tells him is the maximum rate permissible with the speeds and tools employed.

The dexterity of manipulation which usually develops in the hand coincident with the sense of touch, and which is an equally important consideration in modern shop practice, enables punch presses to be fed with little loss of time, and small work to be passed in and out of milling fixtures and drilling jigs with a similar economy of time and effort. A boy tending a certain machine of the semi-automatic type with a dial feed for carrying the work under a set of punches, has been known to develop sufficient cleverness of the fingers to enable him to drop 50,000 small blanks into holes in the dial in a day of 10 hours; at the same time inspecting each blank, and this also by touch rather than visually, his attention being focused upon the general operation of the machine and not directly upon the work fed in the dial.

Similarly, the movements of a machine operator's foot may be developed to an extent that converts this member into a device functioning throughout the work day with the regularity of machinery itself. In fact, in certain instances on punch-press work, hand fed, and requiring foot pressure upon a treadle to start each cycle of movements, the application of the starting pressure may occur with such clock-like regularity as to form a source of danger to the operator in that his fingers for some reason may lag for an instant and be caught under the punch, the movements of which continue as regularly as though occurring without human intervention.

Constituting as it does so essential a factor in modern production, the sense of touch is likely to be developed and utilized still further, rather than dispensed with in our mechanical progress, and the legitimate field of the various hand-operated machine tools as manufacturing machines extended correspondingly along with the increase in the use of power-feed machines of both the conventional and high-power types.

Adulterations in Shop Supplies

Pure food has become a real issue in our national life. After years of agitation the Federal Pure Food and Drug Act was passed, prohibiting the adulterating and misbranding of food products and

drugs entering the channels of interstate trade.

During the past few weeks the daily papers and weekly reviews have given much space to the investigation of the administration of this act, as revealed by the testimony before a Congressional committee. Public sympathy is with the men who have vigorously upheld the law.

The American public demanded pure food and pure drugs.

The American manufacturer should likewise demand unadulterated or, better, honestly labeled supplies.

We treat the maker and seller of quack medicines with contempt; does not the producer of shop nostrums, baths to restore burnt steel, high-priced concoctions for case hardening, ruinous belt dressings and the like, deserve the same treatment?

The adulteration of oils is notorious. Paints may be far from agreeing in composition with the list of ingredients indicated by the brand. Lubricating greases may contain solid matter detrimental to the operation of bearings. Expensive solders are often no better, nor different, from those of standard, proved composition. Turpentine, shellac, cyanide are frequently mixed with cheaper substances with the knowledge that the average consumer cannot detect the substitution.

Excepting the purchases of a few large companies, railroads in particular, but few shop supplies are bought on specification and subjected to careful inspection and analysis. This inspection is an expensive process and is considered beyond a reasonable outlay by the small purchaser. A few commercial laboratories have done good work in supervising the selection and obtaining of supplies of a given quality for their clients. But expense again keeps the buyer of small quantities of such supplies from turning to the laboratories for help.

The entire question rests on common honesty. A seller should deliver what he contracts to deliver, not a misbranded, adulterated substitute.

The principle of Federal control of the quality of merchantable goods in interstate trade has found expression in the pure-food and drug act. The application of this principle should be extended to cover commodities in general use, not merely those in a form suitable for final consumption, but to partly manufactured products suitable for further manufacturing.

Here is an opportunity for the associations of machinery manufacturers to take a vigorous stand in demanding further congressional legislation, to prevent the misbranding of goods in interstate commerce, and thus deal a telling blow to the producer and seller of nostrums and adulterations among factory supplies.

Co-operative Plan Extending

Another application of the coöperative plan of industrial education has been made at the York High School, York, Penn., under the guidance of Director Stanley A. Zweibel. There are at present 40 boys in the machinists' course, which is so arranged that alternately half of them spend a week in school and the following week in the various shops of the city.

Government Investigation of the Taylor System

The special committee appointed by the Speaker of the House of Representatives, consisting of Messrs. Wilson, Lawrence and Redfield, members of Congress from Pennsylvania, Massachusetts and New York, respectively, to investigate the Taylor system, held its first meeting at the Hotel Touraine, Boston, Mass., October 4, 1911.

The immediate purpose of the investigation is to look into the matter of time study, insofar as its application to Government arsenal and navy-yard work is concerned.

New Publications

MACHINE-SHOP PRACTICE. By William J. Kaup. Two hundred and twenty-seven 6x9-inch pages; 185 illustrations in the text; indexed. John Wiley & Sons, New York City; price, $1.25.

Reviewed by E. H. Fish.

For years there has been a surfeit of books on machine-shop practice, most of which were disappointing to shop men. It has remained for Mr. Kaup to produce a really practical, usable book. As the author hopes it proves to be such a book as will make a good textbook for industrial and technical schools, it is likely to prove even more acceptable to apprentices and journeymen who wish to use it as a stepping stone to changing from one machine to another in the shop. It is written in direct shop language, and is arranged in a way which permits a man of limited education to follow its instructions.

The principal criticism that this book is likely to meet is that it is too brief, not but that its explanations explain, but that more explanations given in the same lucid way would be acceptable. There are some details that will likely be changed in subsequent editions. Some of the nomenclature is not in general use about the country, high-speed steel is given rather light treatment in view of its actual use; differential indexing is omitted; but in spite of these minor lapses and some oversights of the proofreader the book as a whole will commend itself to the mechanic.

Chapters are given on each of the standard machine tools, with short ones on Materials of Construction, Measuring Instruments, Gearing, Tool Forging and Hardening. One chapter is devoted to Punches and Dies and another to Jigs and Fixtures, which are all too brief. It concludes with a chapter on shop-cost systems, which is much more understandable than many written on this subject.

Personals

B. B. Bales has resigned as president of the American Automobile Manufacturing Company, West Albany, Ind., and is succeeded by George H. Wilson.

Chris. Smith, until recently superintendent of the Cyclone Drill Company, Orrville, Ohio, has accepted a similar position with the Penn Foundry and M. F. G. Company, Basic City, Va.

E. E. Alexander, formerly shop engineer at the Cooke works of the American Locomotive Company, Paterson, N. J., has become chief draftsman of the Taylor Iron and Steel Company, High Bridge, N. J.

Rupert K. Stockwell, who was formerly assistant general superintendent of the Alpha Portland Cement Company, Easton, Penn., has joined the engineering force of the Robins Conveying Belt Company, New York City.

F. W. Sebelin has severed his connection with the P. A. Geier Company, Cleveland, Ohio, where he held the position of superintendent, and is now acting as master mechanic of the Hill Clutch Company, of the same city.

James Murray has resigned his position as assistant foreman of the foundry of the Whitin Machine Works, Whitinsville, Mass., in order to become general foreman of the General Fire Extinguisher Company, Providence, R. I.

Harry E. Smith has been appointed assistant professor of mechanical engineering, Agricultural and Mechanical College of Texas, College Station, Texas. Professor Smith leaves a similar chair at the James Milliken University.

Claude E. Cox has resigned his position as factory manager of the H. E. Motor Car Company, Minneapolis, Minn., and joined the organization of Arthur D. Little, Inc., Boston, as resident manager of the engineering laboratories, which this organization is conducting for the General Motors Company, Detroit, Mich.

Obituary

C. Franklin Weiler, secretary and treasurer of the Cortland Corundum Wheel Company., Cortland, N. Y., died on Sept. 17, after an illness of about two years; aged, 39 years. Mr. Weiler became associated with the company at its organization in March, 1902.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

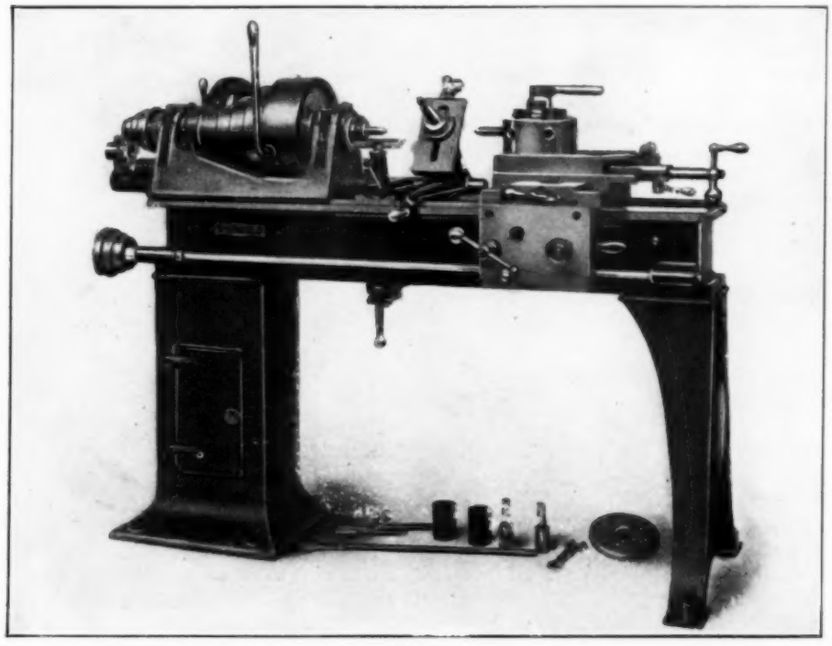
Friction-Geared-Head Cabinet Turret Lathe

The accompanying halftone shows a type of lathe recently brought out by the Springfield Machine Tool Company, Springfield, Ohio.

The turret is designed so that one slight backward movement of the blade loosens the turret and at the same time withdraws the locking pin; while a slight forward movement produces the fractional revolution of the turret for the next tool, at the same time locking and tightening it. A special feature of the machine is one that permits left-hand threads to be cut with right-hand leaders.

The spindle is made of high-grade steel, accurately ground, and has 1⅞-inch hole. The journals are of phosphor bronze.

The front bearing of chasing bar may be moved along the bed by means of tongue and groove to accommodate position of chasing head when operating on work held in chucks or between centers.



FRICTION-GEARED HEAD CABINET TURRET LATHE

The turret is provided with automatic engine feed, with three changes, which may be reversed by the handle at the left-hand side of apron, and directly at the hand of the operator. There is also a longitudinal movement by either lever or screw.

The slide has an additional cross movement operated by a supplementary taper slide, taper being derived from a bar between the ways of the bed, set by a graduated index, to obtain any taper up to four inches to one foot.

The automatic feed allows pieces of any length to be operated on within the range of the machine. When automatic feed is not used, the saddle may be locked to bed by gib screw at right-hand side of apron. The machine rests upon one cabinet and one plain leg, to the former of which can be fitted shelving for the reception of tools, chucks, etc.

The machine has a 15-inch swing, with a turret 7⅛ inches in diameter, and the bed measures 5 feet.

Threading Machine

The machine shown in the accompanying halftone has been especially designed to thread work that cannot be economically produced on the usual screw machine.

The pedestal and arm consist of a single heavy casting through the head of which a hollow spindle is mounted on bronze sleeve bearings. At its inner end this spindle carries one of a standard style D Geometric self-opening and adjustable diehead, modified in design to meet the changed requirements of operation. The die-head is held in a heavy cam sleeve pivoted in a yoke hung from the housing of the spindle. At its lower end, this yoke is attached to a closing rod equipped with two adjustable stops. The forward stop is set to trip the die-head open upon the completion of the thread, thus allowing quick withdrawal of the work, while the rear stop serves to reclose the die-head when the carriage is pulled back against it. This carriage is mounted on slides and is designed to be moved back and forth by hand. It carries a vise operated by a handwheel for holding the work, and while designed particularly for rod threading, can be adapted to thread pieces of special form,

THREADING MACHINE

simply by fitting it with a vise designed for holding the work.

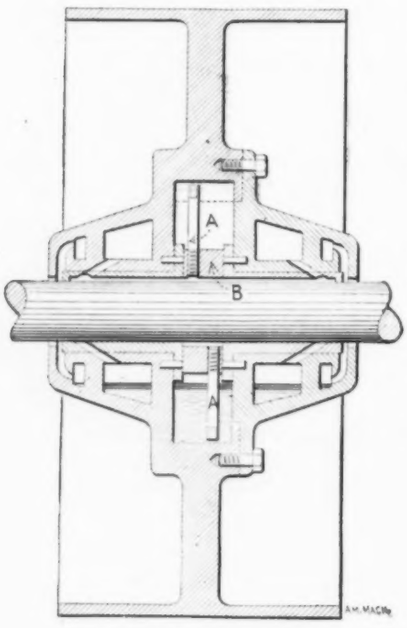
An oil well is placed a short distance below the spindle in the pedestal and carries an oil pump of the gear type driven by a round belt. This pump forces oil through the hollow spindle and at the opening on the die-head on the work, the oil returning to the well through a fine screen.

The range of the die-head with which this machine is fitted is from ¼ to ¾ inch, the sizes obtainable being ¼, 5/16, 3/8, 7/16, ½, 5/8 and ¾. The machine is equipped with a change-speed gear for adapting the speed of the spindle to the diameter of the work to be threaded, as will be noted. An adjustable stop is provided at the off-side of the carriage for gaging the length of the work, and a removable oil-guard placed over the die-head prevents splashing of oil.

The machine weighs 395 pounds and is a recent product of the Geometric Tool Company, New Haven, Conn.

A Self Oiling Pulley

The line cut shows a self-oiling pulley, intended for severe service. The oil tubes *A* have an extending central fin at their ends at right angles to the direction of rotation of the pulley. The tubes *A* are secured in a member *B*, which is secured to the shaft. As the pulley revolves



A Self-oiling Pulley

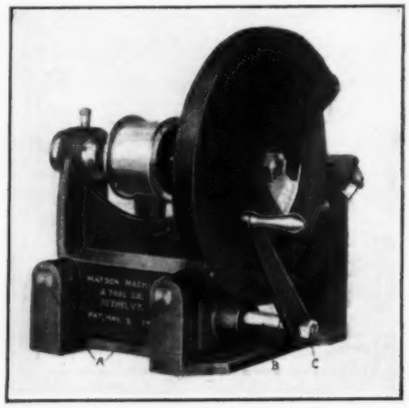
the oil is thrown outward in the oil chamber by centrifugal force, the oil tubes *A* deflect it and it is forced by inertia down them to the oil grooves and along the shaft, returning by centrifugal force to the oil chamber.

These pulleys are made by Edward Cunningham & Co., Canton, Mass.

Cutting-off Machine

The cutting-off machine shown in the accompanying halftone is a recent design of the Matson Machine and Tool Company, Bethel, Vt.

In the main it is similar to this company's regular machine, which has been previously described. The principal change is in construction so that the wheel feeds into the work instead of the



Cutting-off Machine

work feeding up to the wheel, a feature useful for any bar work longer than 8 or 10 feet.

There are two gears on the shaft *B*, which engage in the two round racks *A*. These racks are stationary in the frame *D*. A forward pull of the handle carries the head with the cutting wheel into the work. The nut *C* can be slacked and the handle, which has a tapered hole, placed in any convenient position.

The machine can be set to cut any angle from 90 to 12 degrees, and is made in both bench and pedestal styles.

Automatic Screw Machine for Small Work

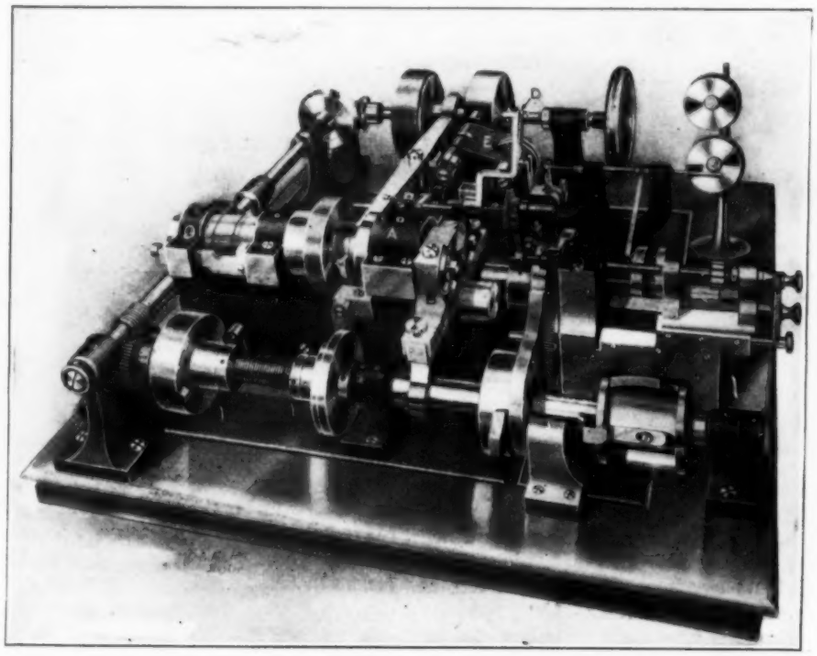
The machine in the accompanying halftone is for the production of small, high-grade screws such as are used in watches, small instruments, etc. It makes the screw complete, including slotting, and as the die is run on and off the wire through a train of gears, very small, delicate screws are made without pulling or stripping the threads.

Screws as small as 0.017 inch in diameter, with 240 threads per inch are regularly made on these machines, and yet the machine is capable of cutting screws as large as 0.070 in diameter, with 70 threads per inch and has a wire capacity through the chuck of 0.125 inch. The machine makes any size screw used in the American-made watch, and larger screws may also be produced at from three to ten per minute according to the size and the material used.

The general arrangement of the drive for the spindle and two cam shafts, is shown in the illustration and the controlling cams, levers, etc., are also clearly seen.

The wire is received through the headstock *A* and is cut and formed into shape through the two circular forming tools on rocker tool post *B*, which is actuated by cams on the two cam shafts, as shown; then the headstock spindle is stopped and held firmly with a brake while the die which is in tailstock *C* is brought into position and cuts the thread.

The die spindle is driven by spur gearing operated by a pair of gear segments carried on the two cam shafts. At the rear of the die spindle there is a gear train connecting with a short lead screw which will be seen passing under the



Automatic Screw Machine for Small Work

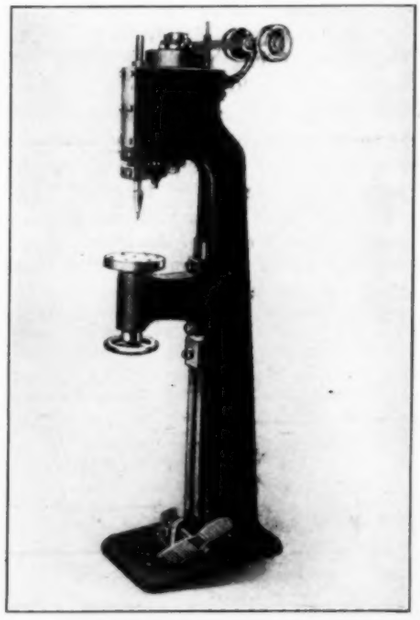
slide of the tailstock. When the segment which drives the spindle forward is in operation, the lead screw is also positively operated to advance the die spindle at the required rate for cutting the thread. Upon the completion of the thread, the rear segment becomes operative and rotates the spindle backward, the die being withdrawn by the lead screw, which is also reversed by the action of the spindle. The transfer arm *D*, which is fitted with a small chuck, swings down and receives the screw as it is being cut off, then swings back into position and the screw is slotted with the slotting fixture *E*. The slotting operation is so timed that it is done while the next screw is being formed into shape, and therefore, does not take any extra time.

The machine is built by B. C. Ames Company, Waltham, Mass.

A High Speed Riveter

The halftone shows a high-speed riveter, built by the Hemming Brothers Company, New Haven, Conn.

This machine is of the elastic rotary blow type. The hammer rod is positively driven by sprocket and chain and effective spinning blows can be delivered to the work at the rate of 6000 per minute.



HIGH-SPEED RIVETER

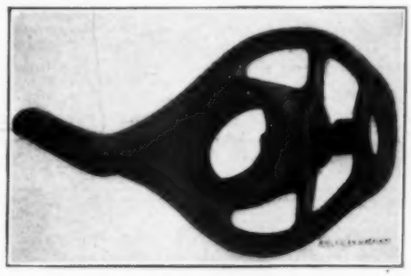
This machine is controlled by foot lever, and can be started and stopped instantly.

The front of the machine is faced and grooved to receive a tongued table of either the horizontal or vertical type.

This machine is also furnished with a lower revolving fixture, which strikes light reciprocating blows from below and is secured to the horizontal table when both heads of a rivet are to be formed simultaneously.

Safety Lathe Dog

The construction of this lathe dog is immediately apparent from the halftone illustration, from which it will be noted that the setscrew is so protected as to avoid the familiar accident due to the lack of such protection. The setscrew can be adjusted by the ordinary type of wrench, and should it become burred or damaged, can be readily renewed by use



SAFETY LATHE DOG

of a socket wrench inserted through the hole in the protection frame.

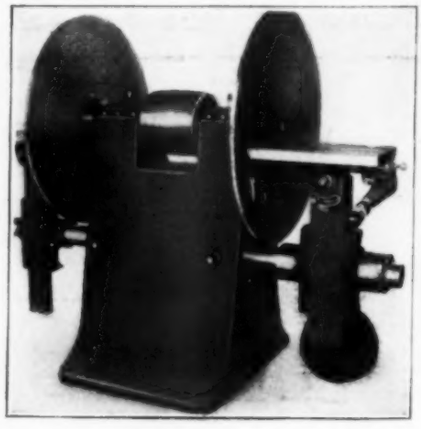
This style of dog is made in standard sizes of crucible cast steel by the West Steel Casting Company, Cleveland, Ohio.

Single Head Disk Grinder

The machine illustrated in the accompanying halftone was recently completed by the Gardner Machine Company, Beloit, Wis.

The machine is of the same general design as this company's regular line, but with all of the dimensions much larger.

The standard size of the disk wheel for this machine is 40 inches, on account of which large size a special pneumatic wheel press is furnished. The spindle is 3 inches in diameter, with a pulley 12 inches in diameter and 10½-inch face. The spindle speed is 620 revolutions per minute, the bearings 10 inches long, and the hight of the spindle from the floor 45 inches.



SINGLE-HEAD DISK GRINDER

The machine weighs 5600 pounds, and it is stated to be the largest single-head disk grinder ever built.

Operation Recorder

In the instrument shown in Fig. 1, 40 distinct records are made on a chart 16 inches wide.

The instrument consists of an oak cabinet, in which is mounted a clock, actuating a 16-inch drum, on which is carried a chart 30 inches long, divided into hour spaces, with 10-minute divisions. The arrangement of the pens is such that they are accurately balanced, pressing with sufficient weight upon the paper to make a clear line, and readily removable for cleaning and filling purposes.

To the shifting lever of each power machine is attached a simple form of contact switch, which closes a circuit through a battery and electromagnet as the machine is thrown into operation, thereby causing the pen to move across the chart from "idle" position to "operating" position, where it will continue to record until the contact is opened by the throwing of the shifting lever, when the pen returns to "idle" position. It is applicable to almost every form of machinery, the contact switch being changed to meet the requirements; for instance, machines operated by compressed air would be provided with a small pneumatic switch to close the circuit. The current can be supplied through a storage battery, dynamo or dry cells, as desired.

FIG. 1. INTERNAL VIEW OF OPERATION RECORDER

In Fig. 2 is shown a portion of a record made on this instrument, the left-

hand position of the record indicating the time the machine was idle, while the right-hand position shows the running time.

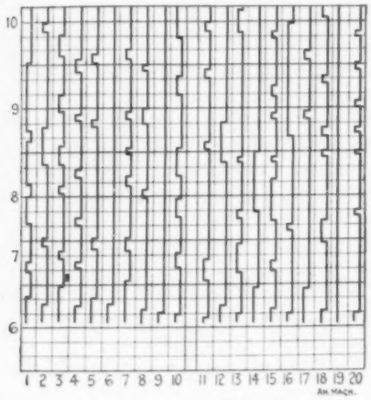


FIG. 2. PORTION OF A RECORD SHEET

The instrument is a recent development of the Thwing Instrument Company, Philadelphia, Penn.

Elastic Rotary Stroke Riveter

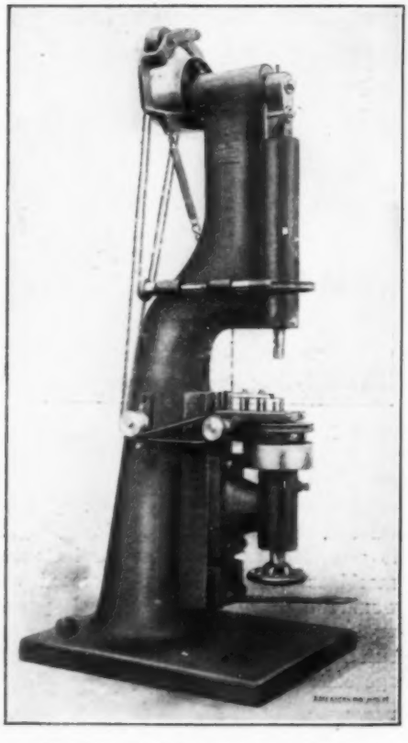
The accompanying halftone shows a ¾-inch riveter equipped with a lower revolving fixture, and which is designed for heading simultaneously both ends of a headless rivet or a piece of wire used as a rivet, doing the work in the same length of time formerly required for heading one end.

The rivets are headed by means of the reciprocating hammer and also by the rotating hammer held against endwise movement in an anvil carrier bolted to the table, between which the articles to be riveted are held. The special feature is the combination and working of the cylinder and hammer rod with the lower revolving attachment.

The direct and central application of the power, with one positive rotary motion of the hammer causes a regularly applied "breaking down" action, so that the rivets are turned down evenly on all sides.

The lower revolving fixture may be removed and the machine used for heading one end of a rivet.

This machine is a recent developmnt of the F. B. Shuster Company, New Haven, Conn

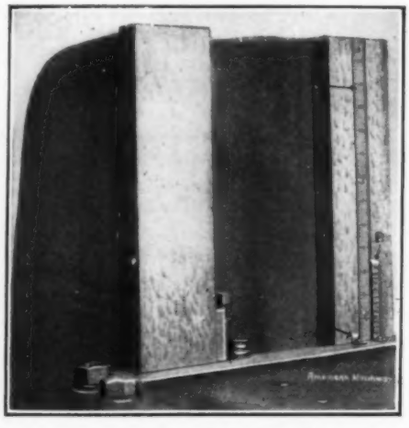


ELASTIC STROKE ROTARY RIVETER

Setting Vernier for Boring Mill Head

The Cleveland Machine Tool Company, Cleveland, Ohio, is putting a vernier scale combination on their boring mills to facilitate setting of the head, as dependence for accurate movement cannot be placed in an elevating screw subject to wear, as well as variation in manufacture. An accurate scale is set into the miller column, as shown at *A*, and a vernier *B* is screwed to the head. The scale is graduated in twentieths on the vernier side and the vernier is of such length that 49 divisions on the scale equal 50 divisions on the vernier, so that the reading for each division is one-fiftieth of one-twentieth, or 0.001 inch. Should the vernier reading not be wanted, the indicator *C* on the opposite side will read directly on the scale in even fractions of an inch.

This setting-scale arrangement is also placed on the miller platens when so ordered.

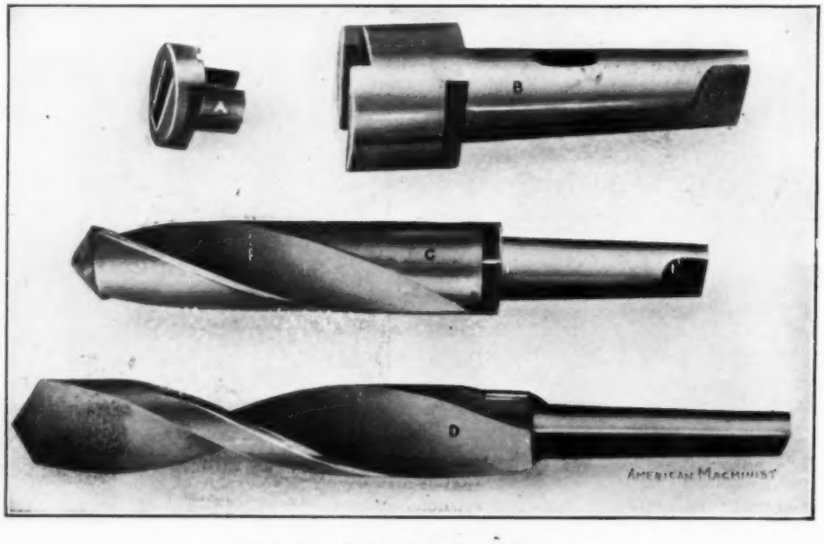


SETTING VERNIER FOR BORING-MILL HEAD

Shoulder Drive for Twist Drills

In Volume 33, page 847, we described and illustrated the Paragon drive for flat-shank drills, made by the Cleveland Twist Drill Company, Cleveland, Ohio, and now the shoulder-driving principle of this has been adapted for use on regular twist drills, the shoulders of which are larger in diameter than the base of the shanks. In the halftone *A* and *D* are the original Paragon combinations; *B* is a sleeve adapted to the shoulder drive and *C* is a large standard twist drill with shoulder cut on it to engage the slot in the sleeve, the shoulder on the sleeve fitting into a slot in the driller spindle.

To prevent chattering while turning thin tubing or castings on the inside, have an assortment of sizes of small rubber gas hose with a coil spring on the inside with the ends of the spring caught together so as to form a ring. These rings can be quickly slipped on and off the work and usually will prevent all chattering.



SHOULDER DRIVE FOR TWIST DRILLS

Russian Trade Opportunities

At the recent convention of the American Manufacturers' Export Association, a paper presented by A. J. Wolfe, dealing with our important trade with Russia, pointed out the following conditions:

The Russian tariff law is a very elastic proposition, and contains very few specific classifications. It depends very much, therefore, on the discretion of customs officials how each imported article will be classified. It is the tendency of customs officials throughout the world to give their government the benefit of the doubt. The Russian customs officials are no different from any others in that respect. Now the German and British consulates have at the Russian custom houses paid officials watching each shipment, and exerting every possible influence in order to induce a more reasonable or lenient interpretation of the customs law. American goods, however, suffer for the lack of a paid consular assistant to be constantly on hand, and to protect the American manufacturers against any arbitrary or irrational interpretations or applications of the tariff. The American consulates in Russia as well as everywhere else are overworked. The officials under the new regime are excellent men, painstaking and anxious to help American manufacturers, but they have to accomplish gigantic tasks with a very small staff.

Another, but far more important point in Russian-American relations is the tendency of American manufacturers to place the representation of their interests in the hands of Germans. This is a fatal error. The British have well established houses run by men of their own nationality throughout Russia.

The Germans are even more consistent in this policy, and will not employ in their houses in Russia a non-German, even for menial work, but the Americans leave the pushing of their goods to the tender mercies of concerns naturally inclined to favor their keenest competitors, with the result that hardly any American goods are sold in Russia in lines where German competition exists.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

Metal Working

NEW ENGLAND

E. B. Holt will build a two-story garage on Main street, Stamford, Conn.

The Waterbury (Conn.) Clock Company will build a garage on Cherry avenue.

The Waterbury (Conn.) Brass Company is building a one-story addition to its factory.

Westfield, Mass., will install a forge and shop for iron and wood work in its industrial school.

The Springfield Foundry Company will erect an addition to its plant on Pasco street, Indian Orchard, Mass.

The Rowbottom Machine Company, of Waterville, Conn., will build a two-story addition to its factory.

Plans have been drawn for the new foundry building on State street, Bridgeport, Conn., for Willard D. Stanley.

The Standard Foundry Company, Gardner street, Worcester, Mass., is to build a large addition to its plant to be used as a pattern shop.

The Peck, Stow & Wilcox Company, Southington, Conn., hardware and tool manufacturer, is building a five-story addition to its plant.

The Russell & Erwin Company, New Britain, Conn., hardware manufacturers, will erect a seven-story concrete building in addition to its plant.

Billings & Spencr Ceompany, Hartford, Conn., manufacturer of drop forgings, steam hammers, etc., will erect an addition to its plant on Russ street.

The Sibley-Curtiss Motor Company, Simsbury, Conn., recently organized, has secured a factory at Simsbury which will be used for the manufacture of automobiles.

The Branford Foundry Company, Inc., Branford, Conn., has incorporated with $2000 capital to conduct a foundry. Incorporators are Walter G. Scholl, John J. V. Cunningham, Peter J. Carney and Michael P. Rice.

The United States Motor Company announces from its New York office that it will purchase a site of about ten acres in the Middle West for the construction of a large plant to manufacture parts for all the models of automobiles made by its constituent companies.

MIDDLE STATES

A garage will be built by Frank Paprocki at Cleveland, O.

H. Miller will build a garage at 2327 Broadway, Indianapolis, Ind.

The Cleveland Foundry Company, Cleveland, O., will erect a garage.

The Alliance (Ohio) Brass and Bronze Company is completing its new building.

A large garage will be erected by S. D. Wise on East Sixty-fifth street, Cleveland, O.

The Mather & Waechter Company, Cleveland, O., tool maker, will erect a new factory.

The Herreshoff Motor Company will build a new motor-assembling plant at Detroit, Mich.

The estate of George M. Pullman, Chicago, Ill., will erect a mechanical training school at Pullman, Ill.

The National Auto Truck Company, Bay City, Mich., has commenced the erection of its new buildings.

A two-story garage is to be built at 1108 Frankford avenue, Philadelphia, Penn., for M. M. Betz, to cost $2500.

A garage will be erected by H. N. White on Superior avenue, Cleveland, O., and will have factory in connection.

The G. H. Breyman & Brothers Company, of Toledo, Ohio, is erecting a new plant for the manufacture of boilers.

Joseph A. Morrow, Albion, N. Y., manufacturing tools, dies and special machinery, will erect a three-story addition.

The Bates & Edmonds Motor Company, Lansing, Mich., making gas engines, is erecting an addition to its plant.

A permit has been issued to T. P. Langhans for a garage at 112 North avenue, Twenty-second ward, Pittsburg, Penn.

The Herron-Webb Engineering Company, whose plant at Monongahela, Penn., was destroyed by fire, will rebuild at once.

The Lucas Machine Tool Company, Cleveland, O., maker of precision boring machines, etc., will erect a new factory building.

The George W. Mason Engineering and Manufacturing Company, West Middlesex, Penn., will immediately erect a foundry.

The Niagara Machine and Tool Company, of Buffalo, N. Y., has filed plans for a $20,000 addition to its plant at 665 Northland avenue.

The Sloan & Chace Manufacturing Company, Newark, N. J., contemplates enlarging its plant. The concern builds precision machinery.

The Cogswell Motor Car Company, of Grand Rapids, Mich., has been incorporated to manufacture motor cars and will need equipment.

The Buhl Malleable Iron Works, of Detroit, Mich., makers of malleable and steel castings, have completed their new foundry and will need equipment.

The Erie Railroad Company has purchased about 320 acres of land in the neighborhood of Crown Point, Ind., for terminal yards, shops and roundhouses.

The Chevrolet Motor Company, Detroit, Mich., recently organized, has purchased a site of forty acres in Detroit and will erect a new automobile plant.

The Gramm Motor Company, of Lima, Ohio, has increased its capital stock from $500,000 to $1,250,000, all of which will be used for installing new equipment.

The Novelty Stamping Company, of Bellaire, O., has selected a site upon which a large factory building will be erected and new equipment will be installed.

The Lake Shore & Michigan Southern railroad will build a round house at East Sixty-Third street and Prairie avenue, Chicago, at an estimated cost of $200,000.

The Webster Manufacturing Company has just completed a $300,000 plant at Tiffin, Ohio, and is now moving from Chicago. Manufacturing power-transmitting machinery.

The M. Mitshkun Company has purchased the plant of the Blue Line Car Works, at De-

troit, Mich., and will start to build freight cars. Many improvements are contemplated.

A building permit has been issued for the erection by the National Supply Company, Toledo, Ohio, making oil well and plumbers' supplies, of a factory building to cost $14,500.

The Ross Machine Company, Lafayette, Ind., has been incorporated to manufacture automobile parts. Capital, $15,00. Directors, William, David E. and Edward A. Ross.

The American Lawn Tool Company, Canton, O., has been organized with $10,000 capital to manufacture garden and lawn tools by A. L. Ricker, John T. Blake, John Lilly, etc.

The Calumet Car Company has been incorporated at East Chicago, Ind., to manufacture railway cars. Capital, $75,000. Directors, A. A. McCalla, T. C. McCalla and U. W. Rogers.

The Rifle Manufacturing Company, Valparaiso, Ind., has been incorporated with a capital of $100,000 by W. W. Rifle, Kimpton Ellis and H. B. McCoy, to manufacture washing machinery.

The Universal Machine Company, Toledo, Ohio, announces that it will soon install more machinery to take care of the increasing business. The company makes marine motors and bag machinery.

The Blair Manufacturing Company, Newark, Ohio, has been organized with $300,000 capital to equip plant and make automobiles and parts. Incorporators, F. M. Blair, J. P. McCune and others.

The Mill-Harvey Tool Company, of Detroit, Mich., has been incorporated to build special tools and do a general machine business. Will need equipment. John and Frederick Mill, principal stockholders.

Contract has been let for construction of addition for the Youngstown Steel and Tube Company at Youngstown, O. This will include an open-hearth steel plant, a blooming mill and finishing mill.

The Pollack Steel Company, Cincinnati, O., has been incorporated to manufacture and deal in iron, steel and other metals, by Emil Pollack, Bernard E. Pollack, Julian A. Pollack, etc. Capital, $400,000.

The Albany Saw Works Company, Albany, N. Y., has been organized with $50,000 capital to manufacture saws of all kinds. Incorporators, E. F. Decker, E. L. Decker, Borden H. Mills, all of Albany.

Folkman Electric Specialty Company, of Cleveland, Ohio, has been incorporated to manufacture electrical specialties and will need equipment. P. S. Metzger, Nathan Folkman, principal stockholders.

The Florence Electric Tray Company, Chicago, Ill., has been incorporated with $75,000 capital to manufacture electric trays and other electric specialties, by F. L. Crombie, Wm. H. Benes, E. C. Howard.

The Midland Electric Heating Company, Chicago, Ill., has been organized to do a general electrical manufacturing business. Capital, $10,000. Incorporators, R. W. Thornton, Julius Goldzier, Henry Hiestand.

The New Jersey Automobile and Supply Company, Camden, N. J., has been organized to manufacture and sell automobiles, etc. Capital, $125,000. Incorporators, H. Morgan Hatch, J. R. Mick, W. B. Walcott.

The Frost Manufacturing Company, Kenosha, Wis., has sold its present buildings and is negotiating for site on which to erect a modern plant. The concern manufactures plumbers' supplies and brass goods.

Logan Square Motor Car Company, Chicago, Ill., has been organized with $2500 capital to repair and deal in autos and do a general repair business, by Frances E. Thornton, Fred Gleor, James M. Sprinkel.

The W. S. Tyler Wire Company, Cleveland, O., makers of all kinds of grill and wire goods have purchased the Chicago plant of the Webster Manufacturing Company. Will overhaul and use in their manufacturing.

The American Roller Bearing Company, Camden, N. J., has been incorporated to manufacture roller bearings. Capital, $500,000. Incoryorators, V. A. Murray, L. A. Myers, Doering Bellinger, all of Camden.

The W. S. Taylor Company, of Cleveland, Ohio, has bought a plant at Fifteenth street and Western avenue, Chicago, Ill., and will soon move in. The company manufactures wire cloth and ornamental metal specialties.

The Specialty Manufacturing Company, Greenfield, Ind., has been incorporated with $20,000 capital to manufacture stamp-vending machines, meat slicers, etc. Incorporators, Geo. W. Davis, C. M. Curry, E. J. Binford, etc.

The Coshocton Steel Ware Company, Coshocton, O., has been incorporated with $50,000 capital to manufacture all kinds of tinned, galvanized and enameled ware by Glenn O. Boyd, C. R. Speckman, William E. Hunt, etc.

The Great Northern Manufacturing Company, Rochester, N. Y., has been incorporated to manufacture motion picture machinery. Capital, $100,000. Incorporators, George A. Wood, H. A. Wood, A. S. Knight, all of Rochester.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will receive bids Oct. 24 for three blacksmith forges (Schedule No. 3970), one 21-inch turret lathe (Schedule No. 3946), one die-sinking machine (Schedule No. 3966).

The Maxant Engineering and Manufacturing Company, Chicago, Ill., has been incorporated to do a manufacturing and mechanical and electrical-engineering business. Capital, $100,000. Incorporators, Basel Maxant, Frank Maxant, Wm. D. Johnson.

The Peerless Gear Tester Manufacturing Company, Cleveland, O., has been incorporated with a capital of $50,000 to manufacture gear testers for automobiles and gear machines. Incorporators are R. L. Ford (the inventor of the device), W. Hoyt, A. W. Kilbourne and others.

The Board of Education, Cleveland, Ohio, will receive bids October 16, for complete foundry equipment for the West Technical high school. Will also receive bids about November 1 for some machine tools, including lathes, shapers, milling machines, automatic screw machine.

SOUTHERN STATES

The Southern Railway Company will erect a new roundhouse at Spencer, N. C., to replace its present one.

The new repair shops of the Atlantic Coast Line at South Rocky Mount, N. C., are almost completed. Modern machinery will be installed.

The B. F. Board Motor Truck Company, Alexandria, Va., has been incorporated to manufacture auto trucks. Capital, $100,000. Incorporators, B. F. Board, T. C. Smith, W. E. Bau, etc.

Improvements that will cost about $250,000 are being planned by the Western Maryland Railway Company, at its yards in Hagerstown, Md., including a new roundhouse.

WEST OF THE MISSISSIPPI

The Oaks Mining Company, Mogollon, N. M., will build a new blacksmith plant.

Herman Zoleska's blacksmith shop at La Crescent, Minn., was burned. Loss, $3000.

The New Hampton (Iowa) Gasolene Engine Company is planning to move to Cedar Rapids, Iowa.

The Newberg (Ore.) Iron Works is planning for the erection of a new plant. J. A. Freeborough is proprietor.

William Reidt, Portland, Ore., will build a commercial garage and repair plant. Modern equipment will be installed.

Campbell & Briggs, Sacramento, Cal., have taken out a permit to build a blacksmith shop on Seventeenth street.

The South Eureka Mining Company, near Sutter Creek, Cal., will construct new machine shops at its Oneida mine.

The Lyle Corrugated Culvert Company will erect a new factory at 171 to 173 Twenty-seventh avenue, Minneapolis, Minn.

The Missouri, Kansas & Texas Railway Company has made an appropriation for a new round house and machine shop at Waco, Texas.

G. E. Ruckstell and J. Conley, Maricopa, Cal., will build a commercial garage and repair plant. Modern equipment will be installed.

Osler & Matthews, Pomona, Cal., will build a commercial garage and repair plant on Thomas street. Modern machinery will be installed.

The Nebraska-Iowa Steel Tank Company has let contract for the erection of a $12,000 factory at Fourteenth and Grace streets, Omaha, Neb.

The Lally Plumbing Company, San Francisco, Cal., is having plans prepared for a new four-story plant. About $100,000 will be expended.

The State Normal School, San Jose, Cal., will build a new manual training building to cost $60,000. State Architect Diggs, Sacramento, has prepared plans.

Richard Ryse, Los Angeles, Cal., is having plans prepared for a commercial garage and machine shop, on South Olive street. Modern equipment will be used.

The Redondo (Cal.) Board of Education has taken out a permit to build a new manual training building at the Union High School. Modern equipment will be installed.

Leon T. Shettler, Los Angeles, Cal., is having plans prepared for a commercial garage and repair plant, to be erected on Pico street. Modern equipment will be installed.

The Duro Automobile Company, Los Angeles, Cal., manufacturer of the Durocar, contemplates the erection of a plant for the manufacture of automobiles at Long Beach, Cal.

The Electrographic Display Company, Phoenix, Ariz., has been incorporated by I. B. Wood and A. H. Green, with a capital stock of $250,000, to manufacture a patented writing machine.

The Kellar-Thomason Manufacturing Company, Los Angeles, Cal., manufacturer of irrigation machinery, pipe, etc, is planning for the erection of a new pipe manufacturing plant at Lodi, Cal.

S. G. Chapman, San Francisco, Cal., representing the Hudson automobile, is planning for the establishment of a branch commercial garage at Oakland. A modern service department will be installed.

The city of Leavenworth, Wash., is having plans prepared for a new school building. A manual training department will be installed, and will be fully equipped. C. F. White, architect, Leavenworth.

The Tacoma (Wash.) Aëroplane Company has been incorporated by James Anderson and W. F. Longmire, with a capital stock of $50,000. The company plans for the erection of a plant for the manufacture of aëroplanes.

The Sarman Autmobile Company, Salt Lake City, Utah, representing the Cadillac car, and, operating a commercial garage, is planning for branch establishments at Ogden,

Utah, Idaho Falls and Boise, Ida. S. H. Sharman is manager.

Manual-training equipment and central power plant will be installed in the new polytechnic high school to be erected at San Bernardino, Cal. Bonds for $230,000 for this work will be voted. Norman F. Marsh, Los Angeles, has been engaged as architect.

The Clive Arms and Manufacturing Company, Los Angeles, Cal., has been incorporated with a capital stock of $250,000, and plans for the erection of a plant for the manufacture of rifles and guns. About $40,000 will be expended for machinery. Albert A. Clive is president.

The Board of Education, San Diego, Cal., has commissioned Quayle Brothers, architects, San Diego, to prepare plans for the new polytechnic high school. A manual training building will be erected in connection, and will be fully equipped. About $200,000 will be expended.

The Bellhouse Flange Lubricator Company, Stockton, Cal., has been incorporated with a capital stock of $25,000, by Clarence A. Grant and I. W. Morris. The company plans for the erection of a plant near Stockton for the manufacture of a patented flange lubricator, for use on railroads.

The city of Centralia, Wash., has granted street vacations requested by the Oregon-Washington Railroad and Navigation Company, and the Northern Pacific Railroad Company, for the new union roundhouse, machine and repair shops. Construction will soon commence. About $750,000 will be expended upon the improvements.

The State engineer, Sacramento, Cal., has completed plans for the new shop building to be erected in connection with the State Normal School, Santa Barbara, Cal. The building will include departments for wood working, machine and forge equipment; mechanical drawing rooms will be established. Estimated cost, $100,000. J. T. Richards, C. L. Lloyd and C. A. Edwards are members of the Board of Trustees, Santa Barbara.

CANADA

E. W. Virden, of Edmonton, will equip a new garage and repair shop.

The Electrical Supply Company will locate a new factory at Listowel, Ont.

The Canadian Northern Railway will spend $3,500,000 at Port Arthur, Ont., installing a blast furnace and iron foundry.

The Stettler Iron and Foundry Works will equip a big plant for manufacturing gas engines and band saws at Stettler, Alberta.

The Yale & Towne Lock Company will equip a complete new machine shop and foundry at its new branch factory at St. Catherines.

The Grand Trunk Pacific railroad is said to be planning for the erection of a large shipbuilding and repair plant at Prince Rupert, B. C.

General Manufacturing

NEW ENGLAND

Hall's carriage shop, Houlton, Me., was destroyed by fire. Loss, $10,000.

The Fisk Rubber Company, Chicopee Falls, Mass., will build a new factory.

Longmeadow, Mass., has voted $5850 for the extension of its water system.

The large grist mill of Ireland Brothers, Corinna, Me., was destroyed by fire.

The city of Lynden, Wash., will install a filtration plant in connection with its water system.

The plant of the Connecticut Valley Lumber Company, Bloomfield, Vt., was burned. Loss, $100,000.

The plant of the Collins Auto and Carriage Works, Pasadena, Cal., was partially destroyed by fire.

The Boston & Albany Railroad will install a new electric motor at its yards in West Springfield, Mass.

The plant of the Somers (Mont.) Lumber Company was destroyed by fire. Loss estimated at $150,000.

The lumber plant of Lawrence & Wiggins, Charlestown, Mass., was badly damaged by fire. Loss, $100,000.

New electric motors will be required for the new laundry at the Massachusetts Masonic Home, Charlton, Mass.

The Porterville (Cal.) Citrus Association has taken out a permit to build a new packing plant for citrus fruits.

The United States Rubber Company will build a two-story addition to its reclaiming plant in Naugatuck, Conn.

The Lincoln Manufacturing Company, Fall River, Mass., is contemplating the erection of an additional cotton goods mill.

Riley Brothers, of Malden, Mass., will erect a factory on Pine street, Woburn, Mass., for the manufacture of patent leather.

The printing plant of the Francis-Valentine Company, San Francisco, Cal., was destroyed by fire. Loss estimated at $50,000.

The American Emery Wheel Company, Providence, R. I., has commenced work on a three-story addition to present factory.

The Pacific Gas and Electric Company, San Francisco, Cal., will build a new substation for electric lighting at Sutter City, Cal.

Mr. Hadlock, North Main street, Belchertown, Mass., has acquired the old shot shop which he will equip for a steam grist mill.

Bids have been received for the remodeling of one of the factory buildings of the Strathmore Paper Company, in Mittineague, Mass.

The Morrell Packing Company, Spoakne, Wash., is planning for the erection of a new packing plant. G. W. McCallum is manager.

The Indian Bureau, Phoenix, Ariz., has appropriated $45,000 for the erection of pumping plants and irrigation system at Parker, Ariz.

Uhlman Brothers, Scappoose, Ore., plan for the erection of a creamery plant at La Pine, Ore. Modern machinery will be installed.

The Peacock Company, Clifford street, Providence, R. I., has doubled its floor space and will manufacture celluloid and leather novelties.

The Pacific Telephone and Telegraph Company, San Francisco, Cal., is having plans prepared for a new exchange plant at Pittsburg, Cal.

The New York, New Haven & Hartford Railroad Company will erect a $22,000 coaling station at the Cedar Hill (New Haven) freight yard.

The Missoula (Mont.) Light and Water Company will install an electric lighting system at Stevensville, Mont. A franchise has been granted.

The California Vegetable Union, Los Angeles, Cal., has taken out a permit to erect a new vegetable and fruit packing plant near Ninth avenue.

Alexander J. Patterson, Conway, Mass., is at the head of a company which will erect a hydroelectric power plant on the Deerfield river at Stillwater.

The Glenwood Mill, Franklin, Mass., used for manufacturing mattress filling, together with machinery was destroyed by fire. Will probably be rebuilt.

The Board of County Supervisors, San Bernardino, Cal., contemplate the installation of a rock-crushing plant, on desert land, near San Bernardino.

The power plant of the United Verde Copper Company, Jerome, Ariz., was partially destroyed by a landslide. The plant will be remodeled and improved.

The Imperial Valley Concrete Company, Holtville, Cal., is in the market for high carbon steel bars for concrete reinforcement. P. L. Hedrick is president.

The milling plant and machinery of the Arizona Alfalfa Milling Company, Phoenix, Ariz., was destroyed by fire. Loss, $10,000. A. F. McCaleb is president.

William Case, Monroe, Ore., has commenced the erection of a sawmill plant. The plant will have a capacity of 100,000 feet daily, and will be fully equipped.

The Pacific Power and Light Company, Portland, Ore., is planning to install a lighting and power system in the Horseshoe Bend district, near Klickitat, Wash.

Plans have been completed for new factory for Lewis Hawthorne on Chestnut street, New Haven, Conn., for the manufacture of sash, doors and builders' trim.

The Rogers & Hubbard Manufacturing Company, Portland, Conn., is erecting a new building in addition to its plant, to be used for the manufacture of bone goods.

A new laundry will be included in the addition to be erected at the Women's Relief Corps Home at Cromwell, Conn. Raymond F. Boker, Hartford, Conn., architect.

The Thread City Laundry Company, Windham, Conn., has incorporated with $1500 capital. Incorporators are Dwight M. Church, Hannah A. Church and Letta E. Hoxie.

The Southern New England Telephone Company has acquired control of the Winsted Local Telephone System, Winsted, Conn., and will erect a new exchange of much larger capacity.

The American Olive Company, Los Angeles, Cal., will build a box manufacturing plant addition to its olive canning factory. A permit has been issued; modern equipment will be installed.

The Greenfield Electric Light and Power Company, Greenfield, Mass., will increase its capital $250,000, same to be used for the construction of a hydroelectric power plant on the Deerfield river.

The Wenatchee (Wash.) Gas and Electric Company has acquired the property and power plant of the Waterville (Wash.) Electric Company. The company contemplates improvements in the plant and system.

Power-plant equipment will be required for the new 11-story bank and office building to be erected at the corner of Main and Asylum streets, Hartford, Conn., by the Hartford National Bank. Estimated cost about $500,000.

The new six-story telephone exchange building of the Southern New England Telephone Company, on Pearl street, Hartford, Conn., is nearing completion. A modern exchange of large capacity will be installed. A power plant will also be installed.

The new Allyn House hotel, to be erected at the corner of Asylum and Trumbull streets, Hartford, Conn., will require a power plant and modern ventilating and vacuum cleaning systems. Estimated cost, $1,000,000. Samuel M. Green, Inc., Springfield, Mass., are the architects.

MIDDLE STATES

Bridgeton, N. J., is constructing a new pumping station.

A carriage factory will be built by Julius Klein at Cleveland, O.

American Box Company, Cleveland, O., is making an addition to shops.

Frank Cavney, 619 South East street, Indianapolis, Ind., will install a boiler.

The Conover Ice Cream Company, Dayton, Ohio, will erect a new two-story factory.

The city of Cleveland, Ohio, plans on building and equipping a brick-making plant.

The Fisher Body Company, Detroit, Mich., is erecting an addition to its boiler house.

The plant of the Patterson Milling Company, Saltsburg, Penn., was destroyed by fire.

The plant of the Ohio Pottery Company, Zanesville, O., was gutted by fire. Loss, $100,000.

The Universal Smoke Consuming Company is buying machinery for its plant at Cortland, N. Y.

The Lelulah Knitting Company's mill at Appleton, Wis., was damaged by fire. Loss, $3000.

The American Dredging Company, Camden, N. J., will erect a power house and coal pocket.

The Benjamin Moore Paint Company, Cleveland, O., will erect a factory to cost $15,000.

The Hardin-Wyandot Light Company, of Kenton, Ohio, will build a new plant in the near future.

Fire destroyed the plant of Neshannock Brick and Tile Company at Volant, Penn. Loss, $10,000.

The Indianapolis Water Company, Indianapolis, Ind., will build an addition to its pumping station.

The Ironton Electric Company, Ironton, O., has increased its capital and will improve its power plant.

The Clark Paper and Manufacturing Company, Rochester, N. Y., will erect a new plant on Dewey avenue.

The Ault & Wiborg Company, of Cincinnati, Ohio, manufacturing ink, will enlarge its plant at Idlewild.

The bottle factory of the Diamond Flint Glass plant, at Vincennes, Ind., was destroyed by fire. Loss, $40,000.

Fire did damage to the extent of $25,000 to the plant of the Peerless Furniture Company, Jamestown, N. Y.

The Studebaker Company is planning to erect a hub factory at Merrill, Wis., to cost with equipment, $35,000.

The Anderson Lumber Company, of Hudson, Wis., will erect a building-material factory at Stillwater, Minn.

The grain elevator of Woodbury & Elliott, Randley, Ind., was destroyed by fire. Loss, $12,000. Will be rebuilt.

The city of Toledo, Ohio, is installing a high-pressure fire-fighting system and will need necessary equipment.

The Globe Woolen Company, of Utica, N. Y., has taken out a permit to enlarge its plant at 119 to 145 Court street.

The Union Coöperative Laundry Company, Pine and Lexington avenues, Indianapolis, Ind., will install a boiler.

The power plant of the Searchlight Gas Company, Warren, O., was almost entirely destroyed by fire. Loss, $5000.

John Wolf has leased a building in Oneida, N. Y., where he will manufacture carriages and do a horseshoeing business.

The Piqua Hosiery Company, of Piqua, O., has prepared plans for the erection of a large factory building at that place.

The United States Tire Company will enlarge its plant at Detroit, Mich. New machinery and equipment will be required.

The Bell Telephone Company, Cleveland, O., will soon erect a new branch exchange and will need power and other equipment for same.

Fitzpatrick Brothers, manufacturers of railroad supplies, 3229-41 Waterville street, Chicago, Ill., will build a one-story boiler house.

Fire destroyed power house, car barns and rolling stock of the Cincinnati & Eastern Interurban Company at Cincinnati, O. Loss, $125,000.

Contract has been let by the Grabowski Power Wagon Company for a new dry-kiln building at Mt. Elliott and Boulevard, Detroit, Mich.

One of the dye houses and a carpet-cleaning house connected with the factory of the Smyrna Rug Company, Hightstown, N. J., was destroyed by fire.

The contract for the boiler-house and engine room for the Grass Twine Company, of Oshkosh, Wis., has been let to Thos. Johnston, of Appleton, Wis.

The American Bridge Company, West Fortieth street and Prinston avenue, Chicago, will build a one-story building to be used as a tin-plating shop.

The Lawrence Storage Battery Company, of Cleveland, Ohio, manufacturer of storage batteries, has moved into its new building and will need equipment.

Kodaw Company, Cleveland, O., has been organized with $5000 capital to manufacture and deal in furniture by C. K. Tanver, V. E. Davis, Walter S. Sapp, etc.

The State of New Jersey is about to advertise for bids to install two new boilers at the State Home for Boys, Jamesburg, N. J. Mr. Kalleen, superintendent.

Ball Brothers, Muncie, Ind., fruit-jar manufacturers, are establishing a zinc-plating factory in Muncie that will give employment to 100 persons at the beginning.

Marshall Field & Co., Chicago, Ill., have commenced the erection of a 21-story office building to cost $2,000,000. Will be equipped with a complete power plant.

The Commercial Milling Company has let contract for a new seven- and ten-story reinforced concrete mill building at Brush and Atwater streets, Detroit, Mich.

The receivers of the Lake Erie, Bowling Green & Northern Railway Company will expend $50,000 in improving the power plant located at Bowling Green, Ohio.

The Adams Express Company will shortly erect a 29-story building at 61 Broadway, New York City, and will be in the market for engines, dynamos, boilers, etc.

The E. I. Du Pont Powder Company has bought a large tract near Crescent, in Albany county, N. Y., and is reported to contemplate the erection of a large powder mill.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids October 24, for 28 electric motors for the Brooklyn navy yard as per Schedule No. 3969.

Christopher Electric Company, Christopher, Ill., has been organized with $20,000 capital to build and operate an electric plant by Thos. Horn, Albert E. Pike, H. M. Rea, T. D. Parkhill.

The Sea Island Tire Company, Cleveland, O., has been incorporated to manufacture and sell automobile and motor cycle tires by J. C. Brooks, A. L. Welch, A. C. Miller, etc. Capital, $15,000.

At an outlay of about $500,000 the Indiana & Michigan Electric Company, which practically controls the water rights of the St. Joseph river, is rebuilding its immense power dam at South Bend, Ind.

The Hydro Electric Light and Power Company, Connersville, Ind., has been incorporated to manufacture and sell electric current. Capital, $100,000. Incorporators, E. D. Johnston, L. R. Johnston, W. E. Lowe.

The Long Island Lighting Company is building a power house at Northport, L. I. (N. Y.), and expending much money in extensions and other improvements of the property of a number of adjacent electric light plants it has taken over.

The Meriam Company, Cleveland, O., has been incorporated with $5000 capital to conduct a general engineering business, including the installation of power equipment by Frank E. Abbott, Joseph B. Meriam, Harry G. Schowe, etc.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids October 17th for worm-geared chain blocks, brass machine screws (schedule 3955), pipe fittings, wrought-iron pipe brass and copper tubing, steel tubes, cold-rolled steel (schedule 3951).

SOUTHERN STATES

The Anchor Duck Mills, Rome, Ga., is erecting a three-story addition.

The Franklin (Ky.) Woolen Mills Company will rebuild its plant recently burned.

Crewe, Va., will issue $25,000 bonds for improvements to its water and lighting systems.

Dothan, Ala., will issue $70,000 bonds for improvements to its water and lighting systems.

Fayette, Ala., will issue $22,000 bonds for improvements to its waterworks and sewer systems.

Dillon, S. C., will issue $38,000 bonds for its sewer system, and $39,000 for improvements to its waterworks system.

The Mississippi Delta Planting Company, Memphis, Tenn., will build a new cotton-oil mill at Scott, Miss., to cost $100,000.

The Hazel-Atlas Glass Company, Wheeling, W. Va., has increased its capital $1,000,000 and will install additional bottle machinery.

The Blue Seal Ice Cream Company, Atlanta, Ga., will erect a new plant and will install candy and ice-cream machinery and a 30-ton refrigerating plant to cost $50,000.

WEST OF THE MISSISSIPPI

The Oak Tree Lumber Company will erect a sawmill at Sauk Rapids, Minn.

The Beatrice Creamery Company will install stokers in its plant at Topeka, Kan.

The Manhattan (Nev.) Earl Mining Company will install new pumping machinery.

The city of Woodland, Cal., contemplates the installation of new pumping machinery.

The Acme Brick and Tile Company will erect several new buildings at Webster City, Iowa.

F. J. Hoerr's cold-storage plant, at Mankato, Minn., was destroyed by fire. Loss, $4000.

The city of Wapato, Wash., has voted bonds for the installation of a municipal waterworks system.

The Butte (Mont.) Central Copper Company is planning to install electric pumping machinery.

The Mason & Moon Company, Los Angeles, Cal., will install a new pumping plant near Puente, Cal.

The plant of the Scott Graff Lumber Company, of Duluth, Minn., was destroyed by fire. Loss, $100,000.

The Dodson-Orr Realty Company, Fresno, Cal., plans for the installation of a pumping plant near Madera, Cal.

The Diamond Ice Company, of Seattle, Wash., will erect a modern refrigerating plant to cost $125,000.

The Swain building, at West Liberty, Iowa, will be remodeled for a button factory for P. A. Hunter, of Muscatine.

The Seattle, Renton & Southern Railway (electric), Seattle, Wash., will build a new substation on Rainier avenue.

The city of Albany, Ore., contemplates the installation of a municipal waterworks system. P. D. Gilbert is interested.

Louis W. Mesnoger, Los Angeles, Cal., has taken out a permit to build a boiler-room addition to his plant on Main street.

The L. W. Blinn Lumber Company, Los Angeles, Cal., has taken out a permit to build an addition to its lumber plant.

The Swan Falls Power Company, Silver City, Ida., is planning to extend its power system from Rich gulch to Flint, Ida.

The Diamond Match Company, Chico, Cal., contemplates the erection of a planing mill and molding mill, near Los Molinos, Cal.

The Pacific Lumber Company, Wilmington (Los Angeles), Cal., has taken out a permit to build an addition to its lumber plant.

The East Pacific Mining Company, Winston, Mont., will install a hoist and a compressor. Henry M. Lancaster, Spokane, Wash., manager.

The Hermiston (Ore.) Telephone and Electric Company, recently organized, is planning to install a telephone plant and system in this section.

The Doernbecher Manufacturing Company, Portland, Ore., furniture manufacturer, has taken out a permit to build a dry-kiln addition to its plant.

The Plummer (Ida.) Home Telephone Company has been organized, and plans for the installation of a plant and system. F. H. McCaslin is president.

A. W. Van Arsdale, Morton, Wash., is planning to install an electric lighting plant, and waterworks system in this vicinity. A franchise has been granted.

Clewett & Monroe, operating the Long Beach (Cal.) Steam Laundry, plan for the erection of a new steam laundry plant. Modern equipment will be installed.

The Johnson Chair Manufacturing Company, Chicago, Ill., is said to be contemplating the establishment of a branch manufacturing plant at Roswell, N. M.

The North Pasadena Land and Water Company, Pasadena, Cal., is planning for improvements and extensions in its waterworks system to cost about $100,000.

The Pacific Gas and Electrical Company, San Francisco, Cal., has taken out a permit to build an addition to its plant on First and Jefferson streets, Oakland, Cal.

The Agricultural College, Logan, Utah, has called for bids for the erection of building to house a hydroelectric power plant near Logan. J. W. Jensen is engineer.

The Mountain States Telephone and Telegraph Company, Salt Lake City, Utah, is planning for the erection of a modern telephone exchange plant at Boise, Ida.

The Diamond Ice Company, Seattle, Wash., will build a large ice manufacturing, refrigeration and cold-storage plant on Western avenue. About $125,000 will be expended.

The Berling Fruit Box Company, Berling Heights, O., is said to be planning for the erection of a wood-working plant for the manufacture of fruit boxes, near Chico, Cal.

The Colusa (Cal.) Broom Factory will establish a plant on River street for the manufacture of brooms and specialties. Modern equipment will be installed. Alva Van Winkle will be manager.

The Daniels Theater, Salt Lake City, Utah, will install an isolated electric generating plant. A special cooling plant and fresh-air ventilating system will also be installed. Max Daniels is proprietor.

N. C. Evans, Hood River, Ore., contemplates the erection of a hydroelectric power plant, of 7000 horsepower capacity, on the Hood river. A franchise for power and lighting work has been asked.

The Pacific Telephone and Telegraph Company, Tacoma, Wash., is planning for extensive improvements and additions to its central station on Eleventh street. New equipment will be installed.

D. F. Thomas, Albuquerque, N. M., is at the head of a company which will build a large beet sugar manufacturing plant near Portales, N. M. The plant will have a capacity of 1000 tons per day, and is estimated to cost $1,000,000.

The Pacific Canning Company, San Pedro (Los Angeles), Cal., has acquired property at Long Beach, and will remove its fish-canning plant to that place. The present capacity will be increased and new equipment installed.

The Coast Range Lumber Company, Mabel, near Eugene, Ore., has commenced the erection of a large lumber mill plant, with a daily capacity of 150,000 feet. The plant will be fully equipped. H. C. Mahon, Portland, is general manager.

The oil-refining plant of the Hercules Oil Refining Company, Los Angeles, Cal., was destroyed by fire. Loss estimated at $100,000, including machinery, engines and boilers. The Fairchild-Gilmore-Wilton Company, Los Angeles, operate this company.

The Lebanon (Ore.) Lumber Company has increased its capital stock, and will build an addition to its lumber manufacturing plant; the present capacity will be increased. An electric power plant is also contemplated for machine operation, and lighting.

D. R. Chapin, Brownsville, Tex., is at the head of a company which is said to be planning for the erection of a large cotton mill plant in McKinney county. A hydroelectric power plant is to be installed on the Devil river. The work is estimated to cost approximately $5,000,000.

The Placer Electric Power Company, San Francisco, Cal., recently incorporated, has acquired water rights near Auburn, Cal., for a consideration of $1,240,000, and plans for the erection of a large hydroelectric power plant to serve this entire district. R. K. Borland is interested in this company.

The American Beet Sugar Company, Oxnard, Cal., has acquired property near Lankershim, for beet growing. The company will erect a large blacksmith and machine shop; a number of loading stations will be erected. If conditions justify, a beet-sugar factory is contemplated in the future. P. S. Carr will be local manager.

CANADA

Victoria, B. C., will equip a big new incinerator.

St. Marys, Ont., will extend its electric power plant.

Port Hope, Ont., will install a new waterworks system.

Port Stanley, B. C., will equip a hydroelectric station.

The Crescent creamery will erect a plant at Winnipeg, Man.

Kelowna, B. C., will purchase waterworks pumping machinery.

Armstrong, B. C., will equip a complete new waterworks system.

Ottawa, Ont., will spend $200,000 extending its waterworks system.

The Canadian Rubber Company is building an addition to its Montreal factory.

The Riordan Paper Company will purchase machinery for a new factory at Calumet, Que.

The Algoma Brick and Tile Company will locate a big new plant at Sault Ste. Marie, Ont.

Ottawa, Ont., will expend $60,000 for machinery for a high-pressure fire-fighting system.

The Hazleton Water, Light and Power Company will equip a big new plant at Hazleton, B. C.

The Princeton Coal Company will equip a big plant to develop power at Princeton, B. C. E. Waterman, secretary.

The Globe Elevator Company, of Calgary, will purchase a large quantity of the latest grain-handling machinery.

The Canada Bread Company, of Montreal, is building an addition to its plant and will install the latest machinery.

The Canadian Pacific railroad will expend $2,000,000 installing a mechanical coal-handling plant at Fort William, Ont.

The Virginia & Rainy Lake Lumber Company will install a large quantity of the most modern machinery in a new mill at Fort Frances.

The Lantz Marble Company, of Buffalo, will locate a branch plant at Bridgeburg, Ont., and will buy polishers, stone saws, lathes, etc., operated by compressed air.

MINING

The Lincoln Gold Mining Company, near Troy, Mont., will install a 30-stamp mill.

The Big Four mines, near Humboldt House, Nev., contemplate the erection of a milling plant.

The Natividad del Valle mines, Oaxaca, Mex., contemplate the installation of new cyanide equipment.

The Tom Head mines, near Red Bluff, Cal., contemplate the erection of a smelting plant. N. E. Guyot is manager.

The Brighter Days mine, Chloride, Ariz., contemplates the erection of a milling plant. F. H. Stull is manager.

The Big Pine Mining Company, near Prescott, Ariz., plans for the erection of a cyanide plant of 100 tons, daily capacity.

The Guerigrito mine, near Cumpas, Sonora, Mex., has commenced the erection of a cyanide plant. The plant will be fully equipped.

Leonard Orynski, operating the Las Canoas mine, near Ventana Bay, Lower Cal., plans to increase the capacity of his cyanide plant.

The East Butte (Mont.) Copper Company, operating the Pittsmont mines, contemplates increasing the capacity of its smelting plant.

The La Grange Gold Dredging Company, Igo, Cal., contemplates the erection of a new gold dredge. About $150,000 will be expended.

The Lucky Jim Mines, Ltd., near Kaiso, B. C., plan for the installation of a smelting plant. G. W. Loper, Spokane, Wash., is interested.

The Parker mine, near Mackay, Ida., plans for the erection of a stamp milling plant. J. M. Stevens, Blackfoot, Ida., is head of this company.

The Jarbidge-Pavlak Mining Company, Jarbidge, Nev., plans for the installation of an ore-sampling plant. Modern equipment will be installed.

The Butte-Alex Scott Mining Company, Butte, Mont., contemplates the erection of a concentrating plant. N. F. Hugo is head of this property.

The Union Hill Mining Company, Grass Valley district, Cal., plans to increase the capacity of its stamp mill. L. B. Doe is head of this company.

The Copper Creek mines, near Mammoth, Ariz., are said to be contemplating the erection of a 2000-ton concentrating plant. R. R. Sibley is manager.

The milling plant of the Enterprise Mining Company, Mogollon, N. M., was partially destroyed by a storm and cloudburst. The plant will be rebuilt.

The milling plant of the Great Northern Mining Company, Blue River district, Ore., recently destroyed by fire, will be rebuilt. F. Litzenberg is manager.

The Welch Tunnel Gold Mining Company, Elk City, Ida., plans for the installation of a hydroelectric power plant, a stamp mill and concentrating plant. R. K. Welch is manager.

The Rich Gulch Mining Company, near Silver City, Ida., will install a 250-ton milling and cyanide plant. Part of the machinery has been ordered. A. F. Stevens is general manager.

Business Item

The Hudson Export and Import Company, 91 Wall street, New York City, has been appointed sole United States agent for R. B. F. bearings, made in France.

Trade Catalogs

Windsor Machine Company, Windsor, Vt. Catalog. Gridley automatic turret machines. Illustrated, 94 pages, 6x9 inches.

Standard Wrench and Tool Company, Providence, R. I. Catalog. Fitzall nut and pipe wrenches. Illustrated, 3½x6 inches.

The Hisey-Wolf Machine Company, Cincinnati, Ohio. Catalog. "Hisey" portable electric machine tools. Illustrated, 54 pages, 6x9 inches.

Moore Drop Forging Company, Springfield, Mass. Catalog. Stillson wrenches, blacksmiths' tongs, drop forgings. Illustrated, 28 pages, 3½x6 inches.

General Electric Company, Schenectady, N. Y. Bulletin No. 4873. Control apparatus for steel mills. Illustrated, 26 pages, 8x10½ inches. Bulletin No. 4878. Cloth pinions. Illustrated, 6 pages, 8x10½ inches.

Catalogs Wanted

W. E. Pettingill, supervising engineer for the Hockanum Mills Company, Rockville, Conn., would like to receive catalogs of power and mechanical equipment for a textile plant.

Forthcoming Meetings

National Machine Tool Builders' Association. Annual convention, New York City, October 10 and 11. Chas. E. Hildreth, secretary, Worcester, Mass.

The National Supply and Machinery Dealers' Association, annual convention, New York City; October 10 and 11.

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Test indicators. H. A. Lowe, Cleveland, O.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Sachs' standardized tool requisitions. J. J. Sachs, Lynchburg, Va.

Wanted—Medium weight machinery to build. Wm. A. Cather, Pottsville, Penn.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery built to order; modern plant; 30 miles from New York. Box 335, Amer. Machinist.

Wanted work in light stamped sheet-metal specialties. Bernardin Bottle Cap Company, Evansville, Ind.

Will buy or pay royalty for a good patented machine, tool, or attachment. Box 1372, New Haven, Conn.

Wanted—Partner with capital in old established manufacturing company. Box 412, American Machinist.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Wanted—To purchase a 20- to 35-horsepower Wagner single-phase motor, 220 volts. Reeves Foundry Co., Trenton, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Autogenous welding of broken cylinders and crank cases is most expertly done by Waterbury Welding Works, Waterbury, Conn.

Small foundry and machine shop, excellently located vicinity New York, open to combination. Box 385, Amer. Machinist.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Special machinery designed and built to order; tools, jigs, fixtures, sheet metal tools and stampings. Frank J. Dyett Co., Ilion, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Joseph V. Woodworth, mechanical expert, will estimate and advise on sheet metal formation, and die, tool, model and light manufacturing work, 165 Broadway, New York, Room 1611.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

Die and press tools from the simplest to most intricate designed and constructed by experts; will make dies to produce parts and articles of sheet metal at minimum cost; will manufacture parts from the tools if this is desired. Address Die and Press Department, The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

Fully qualified English engineer (A. M. I. C. E.), situated in London, already acting as representative for a few good firms, is prepared to undertake English agency for one or two good specialties; negotiations for sale or license of British patents for successful inventions also undertaken. Box 340, American Machinist.

Valuable manufacturing property, about 200 miles from New York City, consisting of machine shop, foundry, pattern shop, smith shop, power house, pattern storage, sheds, etc., suitable for manufacturing pumps, compressors, engines, tools or other machinery; equipment modern and in A-1 condition; railroad sidings into buildings; ten-ton traveling cranes; good shipping point, three railroad systems; fine labor and material market; an established business on a line of high grade machinery could go with plant. If desired, the manufacture of which would utilize a part of its capacity or might consolidate with other business or contract to manufacture other machinery. Box 294, Amer. Mach.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—A first class spring shop foreman, one having had experience in railroad elliptic and coil springs. Box 393, Amer. Mach.

CONNECTICUT

High-class shop foreman wanted, with experience in most uptodate manufacturing methods in medium-sized machines; we are looking for a man not more than 40 years old, energetic, ambitious and knows how to handle men; a man with experience in manufacturing small engines, small refrigerating machines, or cream separators, preferred; lasting position for the right man. Send application, with references and salary expected to "K. T.," American Machinist.

ILLINOIS

Wanted—An executive to take charge of a designing and experimental department; the man desired is one having initiative and the ability to accomplish; the line is a high-grade light interchangeable machinery; a liberal salary will be paid to the right man. Box 397, American Machinist.

MASSACHUSETTS

Wanted—Industrial accountant efficiency engineer; a firm of certified public accountants specializing in constructive accounting and cost systems, wishes to secure the services of a well educated man who is thoroughly familiar with industrial accounting and who has had some experience with "efficiency" engineering with special reference to "task and bonus" and premium plans for paying wages; in replying please give full particulars of experience, age, education and salary expected. Address "Industrial Accountant," Care American Machinist.

MICHIGAN

Milling machine and boring mill hands on jig and fixture work. Address Arthur Colton Co., Detroit, Mich.

Wanted—First-class general foreman for tool and machine departments, also stock man for taking charge of stock department, by automobile company. Box 388, AM. MA.

We are frequently needing good operators for turrets and gear cutters, principallyJones & Lamson and Gleason, and invite applications. Frost Gear & Machine Co., Jackson, Mich.

NEW JERSEY

Wanted—A practical general foreman of machine shop; one who can take a financial interest preferred. Box 350, AMER. MACH.

Wanted—One first-class, thoroughly experienced tool designer for accurate manufacturing; state full qualifications and rating desired. Saurer Motor Co., Plainfield, N. J.

Foreman for department employing about 35 men on Monitor screw machine work; must be familiar with hand and automatic machines; an uptodate energetic man required. Box 348, AMERICAN MACHINIST.

Wanted—Toolmakers, Jones & Lamson and Gisholt operators, and general machine tool hands; good pay, steady employment; mail application, giving wages at last place. Crane Motor Car Company, 96 West Seventh Street, Bayonne, N. J.

NEW YORK

Toolmakers wanted at once, men experienced on dies, jigs and fixtures. Box 355, AMERICAN MACHINIST.

Wanted—Draftsman for machine design and machinery layouts. Address, "Engineer," P. O. Box 536, Niagara Falls, N. Y.

Wanted—Experienced salesman to travel for art metal firm supplying elevator cages and elevator inclosures; apply stating age, experience and salary required. Box 401, AMERICAN MACHINIST.

Wanted—Tool steel salesmen for all States to sell a leading brand of high-speed and carbon steels; write, giving particulars, age, salary expected, experience, territory covered, to Box 259, AMERICAN MACHINIST.

Machine tool salesman wanted; must have at least two years' road experience, and good knowledge of machine tool line; gentleman with technical education, or practical training preferred. Box "S G," AMER. MACHINIST.

Wanted—Leading hand experienced in polishing and plating; must have had experience with electro copper, bronze and other plating processes; good opening; state age, experience and copies of references. Box 402, AMERICAN MACHINIST.

Wanted—In western New York a draftsman experienced in art metal work; must have had experience with elevator inclosures, bank grilles and elevator cages; good opening for suitable man; apply, stating age, experience and salary required. Box 400, AMERICAN MACHINIST.

OHIO

Wanted—First-class machinists on floor and vise work; no labor troubles; steady employment. Box 387, AMERICAN MACHINIST.

Wanted—Draftsman, experienced designer, rotary valve motion for compressors and Corliss valve gear of steam engines; state age, shop experience, reference and salary wanted. Box 373, AMERICAN MACHINIST.

Wanted—A superintendent by company manufacturing high-grade steel specialties; must be mechanically and electrically educated and thoroughly experienced in modern factory methods; an unusual opportunity for the right man; give full particulars as to age, education and experience. Box 394, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—Several first-class tool designers for small fixture, jig and die work. Box 392, AMERICAN MACHINIST.

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 399, AMERICAN MACHINIST.

Wanted—A first-class mechanic familiar with assembling and adjustment of typewriters, vulcanized rubber wheel construction. Box 389, AMERICAN MACHINIST.

Wanted—Screw machine operators familiar with Brown & Sharpe or Cleveland machines; state experience, age and compensation expected. Box 391, AMERICAN MACHINIST.

Wanted—Competent shop superintendent for large steam-engine manufacture; desire someone well acquainted with best modern shop practice and bonus system. Box 403, AMERICAN MACHINIST.

Wanted—A first-class mechanic competent to take charge of a milling department doing a close line of work on small interchangeable parts; must have ability for maximum production on minimum cost; give experience, age and salary expected. Box 390, AMER. MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—Master mechanic capable of handling repair department of finishing works; must be first-class executive, good disciplinarian and able to turn out the work at minimum cost; only thoroughly equipped and experienced man need apply; state fully your qualifications, experience, age and salary desired. Box 360, AMER. MACH.

VIRGINIA

Foreman or superintendent for machine shop, working in conjunction with foundry, forge and wood shop in large manufacturing plant; must be progressive, good organizer of shop force, and experienced in details of machine-shop practice; write fully, giving experience, age and salary expected. Address "Foreman," Box 558, Richmond, Va.

WASHINGTON

Wanted—General foreman for a plant manufacturing a line of knife switches, switchboards, panel boards, steel cabinets and electrical specialties, in a Pacific Coast city; must be thoroughly familiar with uptodate methods of manufacture in this line, having a knowledge of tool making and designing, and be a good organizer and executive; plant employs at present about 45 hands; salary for first year $175 per month; no transportation expenses allowed; applicants must state age, give brief outline of experience and inclose copies of references; do not answer unless sure you can properly fill the position. Box 396, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Superintendent or general foreman; good organizer and uptodate in factory efficiency; United States or Canada. Box 365, AMERICAN MACHINIST.

CONNECTICUT

Mechanical engineer, 15 years' experience, desires change about September 1; good executive, both factory and office experience; reducing cost and raising standard of production a specialty. Box 253, AMER. MACH.

ILLINOIS

Tool designer of long experience on punch and die work, wants position; competent for chief draftsman or assistant superintendent. Box 409, AMERICAN MACHINIST.

Competent draftsman and designer, young man with ten years' experience electrical and mechanical, desires position with Eastern firm; would favor position offering opportunity to work into department where business qualifications would be of advantage; can arrange for interview. Box 367, AMER. MACHINIST.

MASSACHUSETTS

Foreman desires change; the East preferred; steam, gasolene engines or automobiles; A1 tool designer. Box 398, AMERICAN MACHINIST.

Superintendent or works manager is open for engagement; high class and aggressive; good organizer and systematizer; can produce results; 42 years of age; 20 years in charge of various lines of manufacture from finest to large and rough work; best of references; investigation of past record solicited. Box 370, AMERICAN MACHINIST.

MICHIGAN

High-grade factory superintendent desires change; mechanical and executive training with some of the best concerns; good organizer and systematizer, skilled in cost reduction and production; age 38; location immaterial. Box 381, AMERICAN MACHINIST.

MISSOURI

Mechanical engineer and designer, 10 years' shop and drafting room experience, with foremost American and European companies, desires position as designer or assistant superintendent; hoisting, hydraulic and automatic machinery specialty; location immaterial. Box 411, AMERICAN MACHINIST.

NEW JERSEY

Superintendent wishes to make a change, accustomed to fine and medium heavy interchangeable work; a designer of modern tools, jigs, and special machinery for rapid production. Box 383, AMERICAN MACHINIST.

Position wanted as chief draftsman or assistant superintendent by a capable, energetic and reliable man of 40; has broad experience in general engineering and industrial plant equipments and desires to connect with prosperous concern located in the Northern Atlantic States or Canada. Box 353, AMER. MACHINIST.

NEW YORK

Superintendent would consider a change. Box 362, AMERICAN MACHINIST.

By expert mechanical draftsman in New York City. Box 406, AMERICAN MACHINIST.

Machinist with 2½ years' experience on lathe, shaper, milling, wishes to learn the trade. Box 386, AMERICAN MACHINIST.

Assistant superintendent or foreman, novelties; good mechanic and electrician; best reference. Box 407, AMERICAN MACHINIST.

An efficiency engineer, will be open for an engagement after first of October. Address "Beecher," 303 Sumner Ave., Brooklyn, N. Y.

Young man, technical student (Pratt Institute) would like position with superintendent or manager with chance for advancement. Box 384, AMERICAN MACHINIST.

Foreman of gear-cutting and milling-machine department desires position; 17 years' practical experience; executive ability; reference. Box 404, AMERICAN MACHINIST.

Designer, technical graduate, 28, eight years' experience, automatic general machinery, also experimental work, desires responsible position. Box 376, AMERICAN MACHINIST.

Mechanical engineer, expert mechanic, 15 years' experience in designing and operating large machine shop, foundry and erection, desires responsible position. Box 380, AM. MA.

Draftsman, experienced on generators, motors, pumps, special work, wishes position requiring painstaking work; rapid tracer, good letterer; drawings to prove ability. Box 410, AMERICAN MACHINIST.

Superintendent, thoroughly conversant with modern shop efficiency methods, ten years' mechanical and electrical experience, capable of handling men and getting results. W. H. Van Ausdal, Hotel Savoy, Cincinnati, Ohio.

Mechanical engineer, thoroughly familiar with design, construction and testing of valveless, two-cycle, crude-oil engines, European pattern, lampless after starting, desires position. Box 405, AMERICAN MACHINIST.

Cost accountant, 35 years, wishes position with manufacturing concern; 20 years' varied experience, capable of installing uptodate money saving systems; very highest credentials; moderate salary. "Practical," Box 414, AMERICAN MACHINIST.

Superintendent, successful, high-class man in foundry, machine building, tools, dies, structural steel; will make change to connect with concern requiring energetic executive. Address "Mechanical Engineer," Box 368, AMERICAN MACHINIST.

Draftsman, mechanical engineer, 28, ten years' experience, general machinery, tools, presses, automatic machinery, meters, pumps, small interchangeable parts, clever draftsman and designer; neat, accurate, reliable, open for responsible position. Address Box 1701, Bradford, Penn.

Automobile factory accountant, 35 years with broad experience, desires permanent position; absolutely high-grade man, capable of starting and following up simple and practical systems, which will lessen cost of manufacture; references A-1; salary moderate. Address "Executive," Box 413, AMER. MACH.

OHIO

Designer, experienced in dies, tools and automatic machinery, wants position. Box 220, AMERICAN MACHINIST.

A1 mechanical designer; practical, technical, machine tools; exceptional record. Box 395, AMERICAN MACHINIST.

Foreman, practical, A-1 tool room and machine department, can design and build jigs, fixtures, punches, dies and general tools for manufacturing interchangeable parts; age 30. Box 408, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

Mr. Richard T. Earle, Master Mechanic, Oregon & Eureka Railroad Company, Eureka, Cal., writes us as follows:

"You will be interested to know that I have read the AMERICAN MACHINIST for many years, and in the 28 years that I have been on the Pacific Coast, I have relied on it for information in purchasing machinery, also to keep myself posted in the great advances made in the manner of doing work.

"I have bought a great many machine tools since I came to the Coast, and I have always made it a point to be doubtful of either machines or small tools that were not advertised in the AMERICAN MACHINIST.

"The last purchases made were a 42" Bullard boring mill, a 12" Lodge & Shipley lathe, and a few weeks ago a 24" New Haven lathe, also a 48" and 26"by 20' lathe of the McCabe people. These machines were bought of dealers, but from the knowledge I had of them through reading the AMERICAN MACHINIST.

"I have also been much benefited by articles printed in your paper on shop design, and the output of machine tools of the present day.

"August 28, 1911."

* * * * *

Only reliable products can be continuously advertised.

Manufacturing Gasolene Engine Parts

By F. A. Stanley*

Machining pistons in a lathe with special form of driver, and drilling wrist pin holes in an indexing jig.

Handy methods of handling piston rings, connecting rods, and crank shafts; a special driller; and a convenient shop truck and sling for lifting engines.

*Western editor.

A recent article on the shops of the Charles A. Stickney Company, St. Paul, Minn., illustrated and described this firm's methods of machining cylinders and certain other gasolene-engine parts. The accompanying engravings show some further methods of interest in connection with the manufacture of pistons, crank shafts, connecting rods, etc., for the Stickney engines.

Operations on Pistons

The view in Fig. 1 shows a Lodge & Shipley "Patent Head" lathe equipped for machining pistons. The open end of the piston is slipped over the end of the conical chuck or cap screwed on the spindle nose and is thus held centrally, while the driving is accomplished by the flat steel tongue projecting from the chuck. This flat driver slips between the bosses in the piston, the floating connection permitting the driver to adapt itself easily to any irregularities in the rough ends of the bosses.

The jig for drilling the wristpin holes is illustrated in Fig. 2. This is an indexing device allowing the work to be turned halfway over after one hole is drilled, to bring the piston into position for the drilling of the second pin hole.

The jig proper is an open box with a locating member at one end to receive the open end of the piston and a setscrew at the other end to secure the piston against end movement.

The jig is located centrally upon the face of the vertical revolving table and the latter is secured when indexed by means of a lock bolt at the rear controlled by the small handle seen at the top of the upright.

Handling Piston Rings

The piston rings are manufactured in a series of interesting operations, including turning, boring, facing, sawing and grinding, and one of the grinders will be noticed in the background of Fig. 3. This engraving illustrates a convenient form of receptacle for holding piston rings of all sizes.

The receptacles resemble waste cans, but upon examination they will be seen to be made up of four tubular sections each, with suitable retaining hoops and side walls and bottoms of sheet metal. Each chamber has an opening at the side extending nearly the full depth so that the rings at any level in the receptacle can be grasped by the hand and readily removed. This arrangement allows a large number of rings to be taken care of in a reasonable amount of space and enables them to be handled without liability of injury.

Connecting-rod Jigs

Several connecting-rod jigs are shown in Fig. 4. The rods are made with one T-end to which the box for the crankpin bearing is bolted. The rods as they come from the forge shop are first rough drilled through the wristpin end without using a jig, the drill being guided by a conical depression formed in the forging process. Next, the rod is placed in a jig where it is located by the drilled hole which fits a plug in the jig, and then with the jig placed on end the holes are drilled through the "T" for the "box" end and both ends of the rod are center drilled and reamed so that the forging may be placed between the lathe centers and the T-end faced off smooth and square. A jig for this centering and drilling operation is shown to the right of the table in Fig. 4 and the same jig, it should be noted, is also used for drilling a lubricating passage in the rod and for a hole which is tapped in the side of the rod to receive an oiler.

The rod is next placed in a finishing jig where it is held as shown in Fig. 4, while the hole for the wristpin bearing is bored and reamed. Afterward, a bronze bushing is pressed into this hole and hand reamed. The construction of

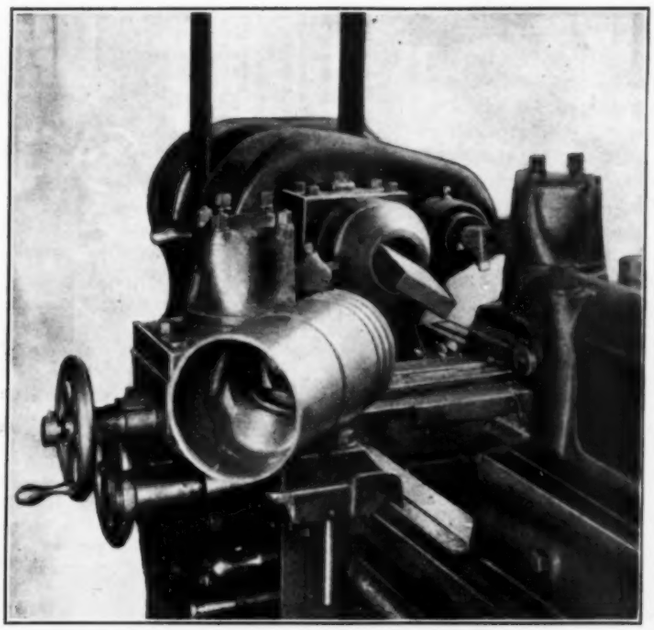


Fig. 1. Lathe Equipped for Turning Pistons

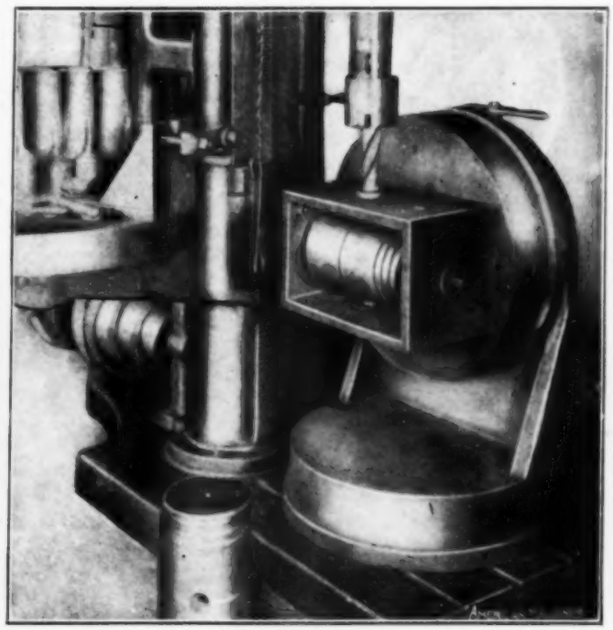


Fig. 2. Drilling Wristpin Holes in Pistons

FIG. 3. RECEPTACLES FOR PISTON RINGS

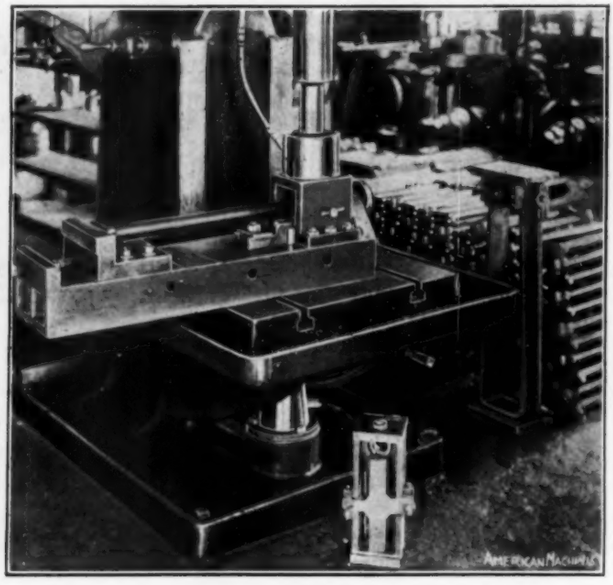


FIG. 4. DRILLING CONNECTING RODS

the jig on the driller table, and of the smaller jig in the foreground is shown pretty clearly by the halftone. Suitable means are provided for locating the work centrally, securing the rod endwise and against movement in other directions; at the same time the work is easily put in place and removed.

CRANK-SHAFT FIXTURE

In Fig. 5 a Bradford lathe is represented as equipped with a fixture for turning crank-shaft pins. The fixture is attached to the faceplate and its outer end adapted to rotate in a bearing in the cylindrical rest bolted to the lathe ways. The turned shaft slides into an opening bored the required amount off center and the web is secured between setscrews in lugs projecting from the end of the fixture. The pin to be turned is thus held against vibration under the cutting action of the tool.

A SPECIAL DRILLER

The igniter-body bushing, Fig. 6, is of tobin bronze. It has a 3/16-inch hole from end to end to receive a removable electrode or pin, and this is drilled in a special machine shown by Fig. 7.

The driller is of vertical type and the bushing to be drilled is secured in a spring collet at the top of the spindle. The spindle is driven by the belt pulleys shown, and ball thrust bearings are provided as represented. The chuck is controlled by lever *A*, which is actuated by a chain connected to a cam handle which is directly opposite the operator.

The drill is secured in the upper end of a 5/8-inch rod *B*, which is secured at the lower end in the feed spindle and which passes up into the hollow work spindle. The feed is applied by turning the handwheel on the lower spindle, which causes this spindle and a nut inside to rotate about a fixed feed screw.

The drill itself is guided in a hardened-steel bushing formed in the body of the spring collet.

A drill of the gun-barrel drill type is used and a high rate of speed and fine feed are employed.

A TUMBLING RIG

Fig. 8 illustrates a method of cleaning the interior of such parts as mixing chambers, pump pipes, etc. The tumbling apparatus consists of a simple stand with shaft and pulley, and with fixtures at the

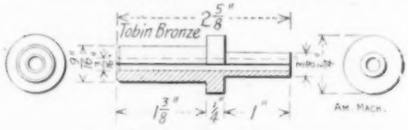


FIG. 6. IGNITER BUSHING

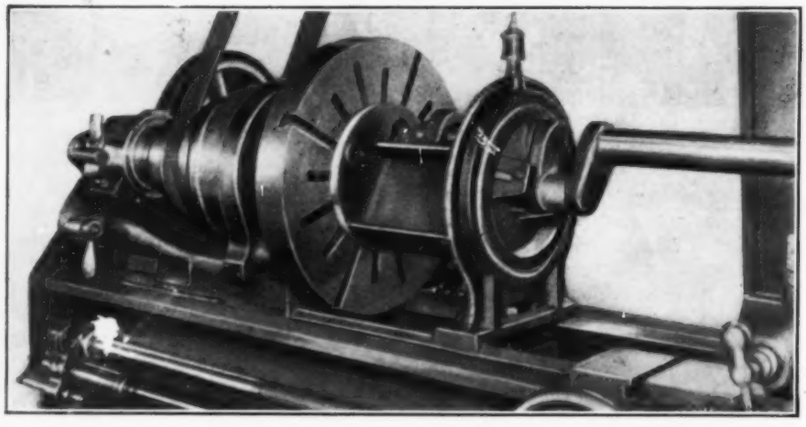


FIG. 5. CRANK-SHAFT TURNING FIXTURE

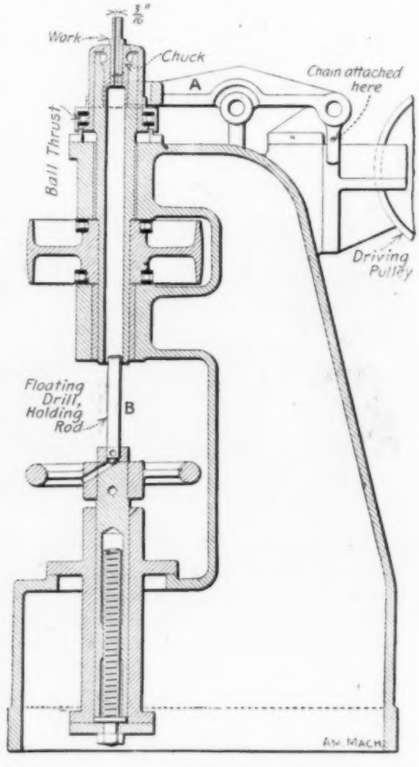


FIG. 7. SPECIAL MACHINE FOR DRILLING IGNITER BUSHINGS

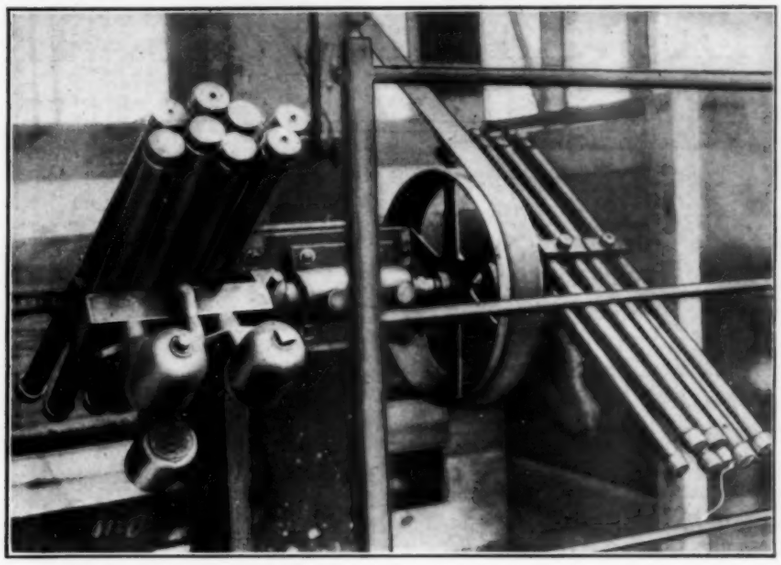


FIG. 8. RIG FOR TUMBLING GASOLENE-ENGINE PARTS

FIG. 9. GRINDING SMALL PULLEYS

ends of the shaft to which the work is conveniently attached. The pipes rest in V's in a small table, and the mixing chambers are secured to the opposite face of the table.

The "stars" placed in the work for cleaning the inner surfaces are prevented from falling out by the caps attached to the open ends of the pieces.

Many of the small pulleys manufactured here are finished on the surface by hand grinding, as illustrated in Fig. 9. The pulley is mounted on one end of a spindle to the other end of which is attached a pulley which is belted from overhead. The spindle is mounted on a swinging frame which the operator presses forward in holding the work to the surface of the grinding wheel.

The pulleys come from the foundry very close to size and with little irregularity in their surfaces; hence the work of grinding the face is accomplished with little difficulty.

MOVING COMPLETED ENGINES

The two-wheeled device in Fig. 10 is a convenient rig for moving skidded engines about the shop. The bent axle between the wheels is so low that the work need not be lifted at the end more than 2 or 3 inches in order to permit the truck to be placed in position.

The sling in Fig. 11 is a four-armed affair with two hooks grasping the rims of the flywheels and two connected to a chain which passes under the opposite end of the skids. An equalizing bar suspends the whole thing from the crane hook, and it is an easy matter to pick up the engine and load it upon a truck.

In the early days of manufacturing industry, attention was not so much concentrated on doing things economically as with the much more difficult problem of doing them at all. The story of Nasmyth's invention of the steam hammer, in response to a sudden demand for means that would forge the crank shaft of ocean steamships, is a case in point. And a good deal of the history of industry during the last century consists of similar incidents, less striking in themselves, but each resulting in a new triumph over natural obstacles becoming the starting point of a whole range of new profits in other industries.

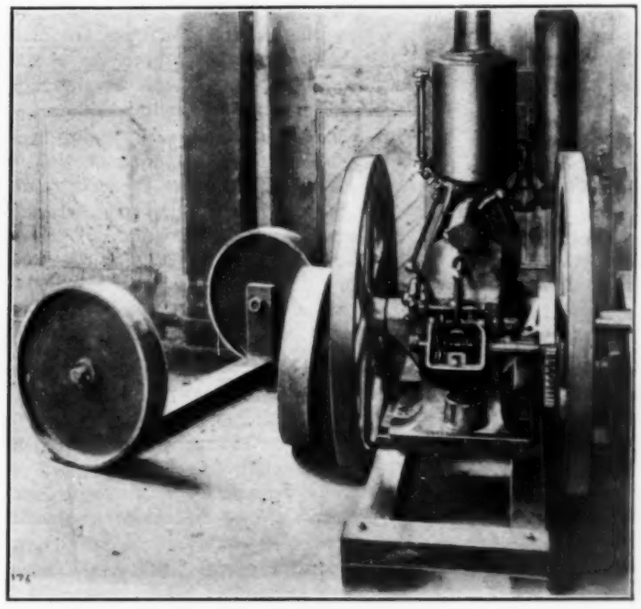


FIG. 10. A HANDY TRUCK

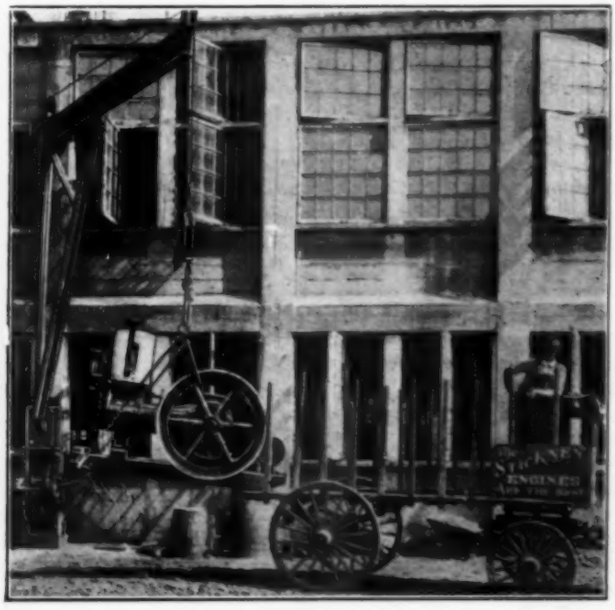


FIG. 11. SLING FOR LIFTING ENGINES

Hints on the Design of Cams—II

By E. Lawrenz

The way to lay out cam levers and springs, the importance of determining the direction of motion of cams and the laws of the curves of cams. An illustrative problem showing the design of a set of cams for a machine to lay sliver in spirals.

The Lever and Spring

In many cases cams cannot be made to inclose the rolls, but are such that the rolls are held against them by an external force. The best means to force a roll against a cam is a spring. When a spring is used, the cam should, however, be so designed that it does the work, not the spring, the spring merely acting to return the lever and its parts after the cam has performed its work.

Of course, there are exceptions to this, but a spring is always a poor, unreliable means. Now, a lever in general has two arms; a lever in connection with a cam and spring has three arms, namely, a roll arm, a link arm and a spring arm. Because a tension spring will exert a variable pull, depending upon its stretch, it follows that the spring pulling a roll against a cam may overload the machine at certain periods, while at other instances the pull may hardly be enough to keep the roll against the cam. To avoid this, the spring and spring arm should be placed as shown in Fig. 10.

Fig. 11 is a diagram of Fig. 10, and therefore the same letters are used. Line $A\,B$ represents a lever capable of swinging through the arc $A\,A_1$ in obedience to a cam and spring S, O being its fulcrum. Line $O\,C$ represents the spring arm; its arc of oscillation is $C\,C_2C_1$.

If we place the arm $O\,C$ into the position $O\,C_0$ (the spring S being held at any point D) in such a way that S_0 will pass through the fulcrum O of the lever $A\,B$, it is evident that the spring will exert the greatest pull in that system. But the lever $O\,C_0$ becomes zero; therefore no motion will result. If now we shift the spring lever to take the position $O\,C$, the pull of the spring is materially less than it was before, but the lever becomes effective, its effective length being $O\,C_2$, and motion will result. If, on the other hand, we shift the lever to the position $O\,C_2$ the spring has weakened still more, but the lever has lengthened, its effective length being $O\,C_4$. Again, if we still further shift the lever until it is in the position $O\,C_1$, the spring is still more weakened but the lever is the longest possible. A further shifting of the lever will result in weakening the spring more and at the same time shortening the lever, which does not interest us.

When the lever was in position $O\,C_0$ we had the greatest pull but no lever arm; consequently we had no motion; when the lever moved to $O\,C$ its effective length became $O\,C_2$, the effective pull of the spring proportional to $C\,C_2 + C_1D$, while C_2d is proportional to the amount of friction on the shaft O. In position $O\,C_2$ the effective length of the lever is $O\,C_4$, the effective strength of the spring is proportional to $C_2C_4 + C_1D$, while the friction on the pin O is proportional to the distance C_4d_1; finally, when the lever occupies the position $O\,C_1$, the effective length of the lever is equal to its full length, the effective pull of the spring is

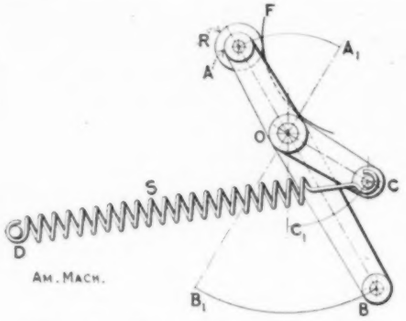


FIG. 10. CAM LEVER AND SPRING

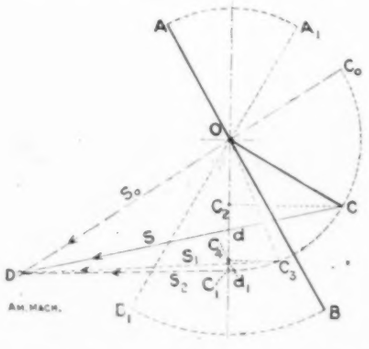


FIG. 11. DIAGRAM OF CAM LEVER AND SPRING

proportional to C_1D and there is no friction on the pin from the spring action. But this can only happen when C_1D is tangent to the arc $C_2C\,C_1$ at C_1; therefore D must be placed on a line tangent to this arc or on a line perpendicular to the lever in its final position. Now the strength of the tension spring will increase according to its stretch in an arithmetical ratio, while the effective lever length decreases according to the law of the cosine of an angle. They are not alike, but the inequity is not so great as it would be had we placed the point C, to which the spring S is attached, on the line $A\,B$, in which case that point would have traveled to its final position on A_1B_1, where not only the spring gets weaker but the lever also shorter. To obtain an absolute equalization is impossible, but a good deal can be done to realize nearly ideal conditions.

A spring connected to a lever has this disadvantage, that the slide at the other end of lever may move too far or not far enough, due to the necessary play in the working parts, and in light machinery, due to slenderness of the levers if they are long. In such cases it might be well to attach the spring to the slide itself if the pressure is light and the motion short. This disadvantage is also true of cams where the rolls are running in slots, the same being closed, and where there is no need for a spring.

In connection with cylindrical cam operating levers there is another feature to which attention should be called, namely, the relative position of one to the other. In Figs. 12 and 13 a lever is shown placed in the most disadvantageous position. This is not a supposed case at all, for there are thousands of machines in daily operation which have just this arrangement. The only excuse in this instance is that the designer of these machines could not help himself. From Fig. 13 it is clearly seen how difficult it is to cut such a cam; how much more difficult is it if the cam is a closed one? The tool to machine such a cam must of necessity be a special machine and the roll barrel shaped. While all cylindrical cams actuating levers correctly placed should be cut on special machines in which the cutters are held on levers equal in length to the actual levers, yet the error is not very great if the cams are cut on regular millers.

In Fig. 14 the relative positions of lever and cam are shown, in which the roll is always normal to the cam face, the oscillation of the lever is free and easy and there are none of the objections inherent in an arrangement shown in Figs. 12 and 13.

The Direction of Motion of the Cam

Of very great importance for the smooth, easy and ideal running of a machine with cams and levers is the direction of motion of the cam with reference to the fulcrum of the lever. In Fig. 15 an abnormal cam and lever are shown, abnormal because of the too steep rise of the curve. This cam is laid out to produce uniform motion, hence the angle formed by a tangent to the curve and a tangent to a circle at any point of mutual osculation is constant throughout.

If O is the fulcrum of the lever OA_2, at the end A_2 of which is the roll R_1, and the cam is running in the direction of the arrow, then it may easily happen that the machine will stop when the roller is in the position shown in the sketch. For, if we draw a common tangent to roll and curve RS and a perpendicular RT to the line OA_2 produced to A_3, then the angle A_3R_1T is a right angle, and the angle, ν formed by RS and R_1T, is the angle indicating the difference between a right angle and the angle A_3R_1S. This difference is too small; if we suppose α to decrease, which happens as soon as the lever shortens, the angle A_2R_1S approaches a right angle more and more, and when that angle is a right angle there is no doubt but that we have a positive lock.

Due to the fact that the lever swings in an arc of a circle, as we suppose motion to result from the rotation of the cam in the direction of the arrow, the lever lengthens effectively; that is, while the curve moves toward the fulcrum, the roll shows a desire to climb up on the curve. Now, this is contrary to natural law, and this apparent desire to climb up the curve is in reality the force which opposes free motion; in other words, the machine moves hard. If the direction of the motion be reversed the resulting effects also would be reversed. While the effective length of the lever would increase, this increase would actually be beneficial in lifting the roll. While this particular cam here shown might work under these circumstances, it is none the less not a good cam which I would use under normal circumstances. Now what is true of flat cams is also true of cylindrical cams, except that here the temptation to shorten the lever may be greater than in the case of flat cams.

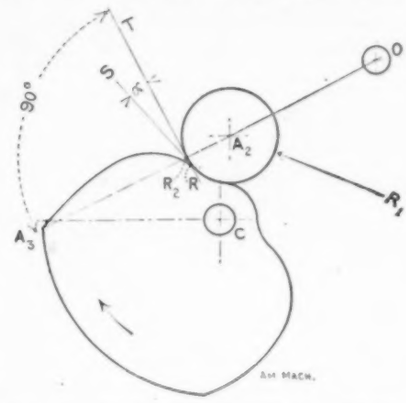
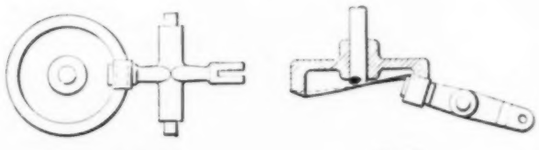
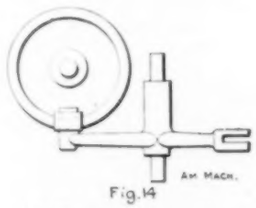


FIG. 15. DIAGRAM SHOWING IMPORTANCE OF DIRECTION OF MOTION OF CAMS



UNFORTUNATE CAM-LEVER ARRANGEMENTS



A BETTER CAM-LEVER ARRANGEMENT

LAWS OF THE CURVES OF CAMS

In many cases it is sufficient if the curves of cams give uniform motion. Especially in slowly working machines, or when the machines move rapidly, it may be only necessary to design cams with curves that impart harmonic motion to the bodies moved. However, this does not always apply, for cases may arise in which the cams must impart a motion which can be changed under no circumstances. A case of this nature is a machine to coil sliver of which ropes are made. Sliver is a lifeless, neutral material; that is, it has no elasticity, no strength. It comes in bulk to the factories, and it is desirable to have it in such shape and quantities that it can be handled easily; so it is coiled in closely laid spirals, one layer on top of the other to a hight of several feet. The center lines of such spirals are shown in Fig. 16. The dotted line indicates the center line of a layer of spirals below, starting near the pole P and running out to the periphery where it reverses for the upper layer and where the center line is shown in full. These are spirals of Archimedes. To design a cam for a machine to draw such a curve is easy; also is it easy to design a cam for the purpose in hand. There exists, however, a modifying factor, necessitating the introduction of another cam influencing the whole machine. This factor consists of the fact that the sliver is delivered at a constant speed. If we now inspect Fig. 16, supposing to start at the outside where the full line begins, and bear in mind that sliver is handed out to us in an incessant and constant stream, it is easy to see that on the outside of the coil we may take our time in laying the sliver, for a good deal of sliver is necessary to go around that periphery. These layers are not circles, but instead approach the pole P; hence, for every spiral laid we must increase our speed of laying, and, finally, when we reach the pole itself, we must move with lightning rapidity in order to get rid of the sliver piling upon us.

There is, of course, nothing gained by reaching the pole; hence the machine is designed to start to lay sliver somewhat away from the pole. Knowing the velocity with which sliver is delivered, and having established the number of spirals, it is a comparatively easy matter to proceed in designing the cam.

Fig. 18 is a vertical section of a machine reproduced less to show the actual construction of the different parts than the arrangement. In Fig. 17 is a top view of the parts that are of immediate interest to us.

At F is a funnel or guide, traveling on a rail and moved by the cam A through the lever L and its link; it serves to lead the sliver equal distances for each vectorial angle; therefore this cam is of uniformly constant rise and fall. But as F approaches the pole, the machine must gain in speed such that it will take care of the sliver as delivered. As the machine changes its speed from point to point, the velocity of motion of cam A must vary accordingly. Again, when the machine has laid one layer of spirals, the cam A must have turned but one-half of a rotation; the other half must guide F inward for the succeeding layer of spirals.

At E is a cone, the function of which is to keep the coils down, and it is positively driven through gear G and idler G_1, Fig. 18, and the stationary gear G_2. As the machine must rotate with variable speed the cone also must have a variable speed. To the cam A is fastened the sprocket G_3, in mesh with sprocket G on idler G_1, so proportioned that the cam A is behind one whole turn when the machine has placed two layers. In order to get the variation of speed of the machine, roll R is introduced, which must be made to travel a distance c—b, and for this purpose we need the cam C. This cam is driven at the proper but constant speed from a motor through the sprockets S, S_1 and the chains S_2, the roll R being carried by a slide having at the other end a cam roll engaged by cam C. At the lower end of the motor shaft is the disk M, running, like the motor, at a uniform speed. Since sliver is fed

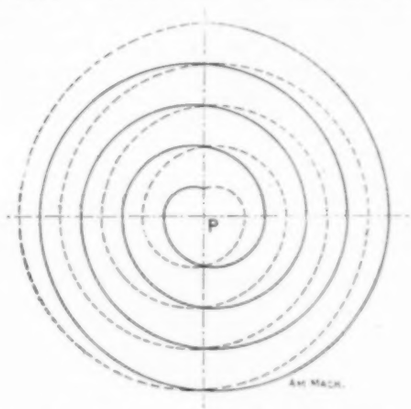


FIG. 16. SPIRAL LAYING OF SLIVER

by a roll having constant velocity, its rate of delivery may be represented by

$$V = 2r\pi n, \qquad (1)$$

and the rate at which spirals are laid at any instant by

$$V_v = 2r_v\pi n_v, \qquad (2)$$

in which

V = Velocity of sliver delivered;
r = Radius of roll feeding the sliver;
n = Revolutions per minute of the roll;

But V_v must always equal V.

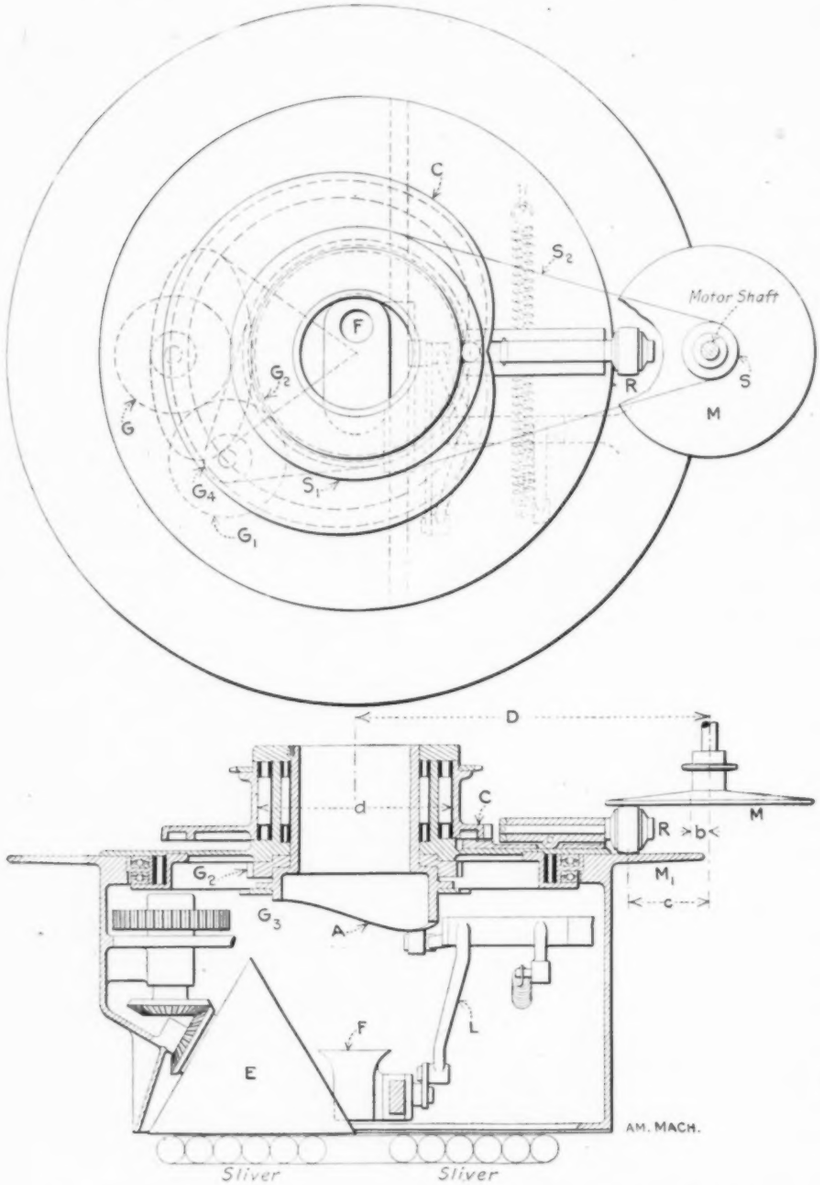
We, therefore, have

$$n_v = \frac{nr}{r_v}. \qquad (3)$$

This equation gives the number of revolutions of the machine, if the spirals became circles at any instant.

We cannot start at the pole because there $r_v = 0$, hence equation (3) becomes

$$n_v = \frac{nr}{0} = \infty,$$



FIGS. 17 AND 18. DIAGRAMS SHOWING CAMS IN SLIVER-LAYING MACHINE

V_v = The speed at which spirals would be formed at any instant, if the spirals became circles at that instant;

r_v = The radius vector of the spiral at that instant;

n_v = The speed of the machine at that instant.

which means that the speed of the machine is infinitely great, something we cannot attain to.

We cannot approach the pole too near, because then the cam C becomes impossible. We cannot make the curve of the cam at its lowest point too steep, unless we make the cam excessively large.

The quantity n_v is easily gotten after we have established the spiral at the pole by a repeated application of formula (3).

Having established the speeds at the pole and the periphery, we next determine the distance D. Knowing the speed V_m of the motor, we determine the distance b, which is the distance from the center of the motor to the center plane of the roll R in its position nearest the center of the motor, and which gives the slowest speed to the machine.

Let R_v be the required radius of the disk M; we then have

$$V_m b = n_v R_v, \qquad (4)$$

or

$$R_v = \frac{V_m b}{n_v}. \qquad (5)$$

Now,

$$D = R_v + b.$$

The distance c we get from the equation

$$V_m c = (D - c)\, n_v, \qquad (6)$$

from which

$$c = \frac{D n_v}{V_m + n_v}. \qquad (7)$$

The throw of the cam, which is equal to the travel of the roll R, is simply $c-b$, and this value must be found as many times as we please to divide the time of the cam, which is ½; that is, one-half turn. The resulting cam curve will guide the roll R in such a way as to insure the necessary speeds of the machine.

While cam C does not produce the spiral shown in Fig. 16, it is an essential part of the machine, and requires more work in its design than cam A. Cam A alone will trace the spiral simply by turning the machine at any speed, but it cannot take care of the incessant and constant flow of the material. This illustration has been chosen because it shows the care necessary in designing cams.

Electricity in agriculture, according to a consular report, is to receive serious consideration in England under the direction of the Board of Agriculture, the research and experimental work planned involving an appropriation of $250,000. So far as wheat is concerned the beneficial effect of electricity has been amply demonstrated by experiments already carried out. With three different fields of wheat, each growing electrified and nonelectrified crops, so distinct was the improvement in the electrified crop that a line of demarcation in the field could be plainly seen. Satisfactory experiments have also been tried in England upon sugar beet. In Germany experiments have been carried out with an electrical spray of water in order to get over a difficulty which has been encountered; namely, that electrified crops produce less in dry weather.

Transactions of the Inefficient Club*

By W. H. Booth

The imaginary doings of an American efficiency expert in a small British shop and what resulted therefrom.

"Before you put a system into operation, think out its effects to the end."

*Illustrated by R. W. Semple.

We are a small community and live in simple style in a far back place. I would prefer not to give the name of our little town, because we have gone back to our old ways after a period of stress, which was interesting while it lasted and has since furnished an unending subject of conversation. It all happened in this way.

Saturday evenings it was our custom to meet at the Black Bull. By we I mean the 12 or 14 men employed at the Hayrake and Muckfork Works, which was the only works in town engaged in mechanical pursuits. On one particular Saturday evening the subject of discussion was a subscription for Bill Jones, who was off work on account of the loss of the top joint of a finger in the circular saw. Bill was not quite idle for the old man had put him to forking up potatoes and paid him three-quarters wages until he could come back to full work. A commercial traveler staying in the town over night told Bill he ought to play the old man for compensation. But Bill told him to mind his own business, he (Bill) had no grudge against the old man and had himself moved the guard which had been fixed on the saw and so felt morally responsible for his own injury.

"——— THE COMMERCIAL MAN WENT OFF WITHOUT MUCH CEREMONY ———"

The end of this argument was that the commercial man was sent off without much ceremony, though Sam complained that he had bruised his toe. Sam would always wear such light boots and he forgot this fact when the argument was at its hight and the time came for action.

THE FIRST SIGHT OF STRANGER

Well, to make the story short we collected 7/9 this Saturday, including threepence from a stranger who sat by the fire listening to the talk. He did not give his name but he said he was in this slow old country to "recooperate" after a strenuous time across the pond. He said everybody was talking about system in America and that he knew all about it. He guessed he could teach our old man how to make money by doing work at better efficiency. He explained that four men under his system could do more work than the whole lot of us were now doing. He didn't seem to think it helped business to let the men out of the shop when a flying machine was expected to pass overhead. He said this had wasted 17¼ minutes of 13 men, and when multiplied out it did look a lot—over three hours.

Little Joe, the boy, reckoned up it meant 4½ pence at his rate of pay and he put the odd half penny into the collection box next day as a salve to his conscience for his share of the waste of time.

STRANGER MEETS THE OLD MAN

On Monday Stranger came to see the Old Man, who showed him around the shop. He looked closely into everything and Joe heard him tell the Old Man he must be wasting a lot of coal and would he show him the engine. So the Old Man took him round by the rose garden to the back of the building and showed him the old moss-grown breast wheel turning round about 1½ turns in a minute and plenty of water to spare going down the stream.

Stranger dried up about wasting coal, but said it was just as wicked to waste water. The Old Man ought to put in a turbine, instead of the old 20-foot wooden

STRANGER TOLD "THE OLD MAN HE MUST BE WASTING A LOT OF COAL AND WOULD HE SHOW HIM THE ENGINE"

breast wheel and save 30 per cent. of the water. Then another turbine and a dynamo would light the shop and save candles. The old man looked ashamed to confess that the previous winter had cost him only 10 shillings for candles. Stranger showed him how he might save this and Joe heard him say that metal filaments used very little electricity.

The First Efficiency Orders

Stranger stood a long time next to Sam at the long lathe. Sam had a habit of scratching the top of his head when his lathe was running on top speed, and Stranger said Sam did more efficient work than any of us. Next morning there was a notice on the shop door that all men working on a machine must scratch the tops of their heads and would receive two pence extra for every hayrake extra that was turned out.

Bob Smith was declared to be the best hand at chipping. Now Bob was left-handed. On Wednesday a notice was put up ordering all men to hold their hammers in the left hand on pain of instant dismissal as inefficients. Four men were

The Efficiency Notices on the Door

sacked on Saturday and two were laid off with battered right hands and those who were left had to work mighty hard to keep up with the work.

Organizing the Inefficient Committee

Stranger seemed to fascinate the Old Man. Next Saturday the Old Man and Stranger came to the Black Bull and gave a talk on efficiency. Next day, being Sunday, the eight of us who had been sacked or declared inefficient went down to the Limekiln woods and held a meeting under the pine trees. It was resolved that we form ourselves into an inefficient committee; that since it was necessary for us to live, we, as a committee, would receive our usual wages, but would not interfere with the work in the shop nor occupy space in it, but would take our turns in supervising the work and seeing to the carrying out of the many new rules.

Stranger had noticed that a bit of red-painted tool steel did most work between grindings, and after this all drills and lathe tools were kept painted red. Bill laughed about this because, he said, it had nothing to do with the paint. The red-painted steel had been so painted to be known as a bit of Firth's Best, and that was why it did so much work.

Another order was to use nothing but Michigan pine for patterns. Stranger said it was much used over the pond and American patternmakers hustled considerably, and he guessed it must be the wood.

Opening the Club Room

Sunday evening we met the Old Man coming home from church. He looked half ashamed to meet us, especially as there had been a sermon by the old bishop, who was on a visitation, on Christian Forbearance. Bill spoke up to

The Sheet Steel Medals "Were Duly Presented to the Efficient Ones on Sunday Afternoon"

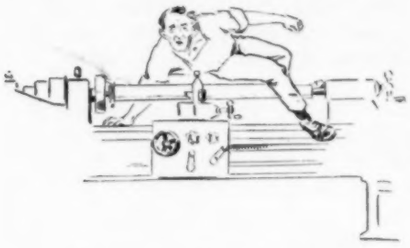
him and told him all about the pine-tree conference as he had gotten it written down in a minute book. Bill was slow but very orderly, and was secretary of the Mutual Improvement Club and knew all about what he called keeping minutes. He explained that though we must live, we knew how sinfully inefficient we were, and we would leave the work to the highly efficient and see to it that they were encouraged. He went on to suggest that the top room over the stables should be cleared out and whitewashed, and a bit of carpet and furniture put in it.

This was done and the Parson, hearing about it and thinking we were starting an improvement society, sent us books and papers from the Church Institute. The Old Man paid old Margery half a crown a week to look after the room and sent up a tea kettle and crockery for use at what Bill called the "round-table conference," which was held every day at "four of the clock." (That is the way Bill wrote it in the minutes.) It was agreed that every morning two "inefficients" should attend at the shop at 6 o'clock to encourage the efficients; then two others from breakfast to dinner time and two others until tea time. When for the rest of the day the last two of us kept watch.

No efficient was allowed in the club room, but when we had finished tea little Joe was allowed to carry out the remainder, well diluted, to the shop and a pannikin was served to each man. Seventeen seconds were allowed for drinking it, so it was served quite cool.

The first trouble arose when first one and then another of the efficients ceased to attend church on Sunday morning. Their excuse was they were so tired and Sunday was a day of rest. Instead of working easily for 10 hours a day, they were now compelled to work 12 hours in order to keep up the shop turnover. Parson came around to our club and then walked around the shop. All the efficients were so busy they had no time to air their grievances. Parson took the arm

chair and had a cup of tea, over which he said grace, and he said that the new system seemed to work all right, but he warned us about Satan and mischief and idle hands and so on. He walked around the room and stood a long time in front of our framed illuminated motto, which read in blue and gold old English letters:



"HIGH EFFICIENCY SAM"

"Bear ye one another's burdens."

Bill explained to him that we poor inefficients were risking our spiritual lives by this supervising work in keeping the fortunate efficients in a state of grace and hard work. Bill sighed and held up his maimed finger, which he declared was the cause of his inefficiency that had thrust upon him this grave responsibility of supervision. Parson couldn't say anything in view of the finger, or rather, of the want of it.

MEDALS FOR THE EFFICIENT

Meantime, the Old Man was too busy with system and card index and his books and slide rules and calculations to do anything else. But we saw to it that the shop output was kept up. We stamped out round disks of steel plate, and by the help of wax and a steel scriber and some acid we etched the work "Efficient" upon each one and brazed a pin and loop on the back and they were duly presented to the efficient ones on Sunday afternoon. Bill made a speech, in which he said that they were "Poor encouragement lase aters." This he said was French for "let every man do his duty." After that he dismissed them with a sort of blessing and said that it was time to hold another committee meeting to consider a hustling plan suggested by Stranger.

We asked Stranger when he thought of returning to "God's Country," which was the name he gave to his home. He said not until he left convinced that he had extended the blessing of "my-ism" throughout this dark swamp. He said he was afraid the aforesaid G. C. was getting too hot for him. Bill said, yes, the papers said it had been 104 degrees in New York. Stranger laughed and said he wasn't thinking just of that sort of being too hot and that he had spoken figuratively; our inefficient intelligences hadn't quite taken in his meaning, but Bill looked across at me, closed one eye slowly, bulged one cheek and somehow we both smiled.

Then Bill gazed at his hand and said what a pity he had lost his finger now that his hands were clean and soft and his nails were long and out of mourning. A rule of the club was that every inefficient must be dressed in tweed clothes and wear a white shirt and no member must appear in the room in dirty boots.

HONORS ARE BESTOWED UPON THE CLUB

After a while Bill wore a silk hat and began to carry a cane, and he was actually invited to the banker's garden party. Mr. Gold, the banker, was candidate for parliament for the division of which our town was a part. Sam, the best efficient, said that when bankers invited people to garden parties it was because they had to ask them to something and they were not the sort of people they would like to see in their drawing rooms. But Sam was always a bit spiteful. Bill came back very full of himself and said that the Duchess had talked to him about our club which she had heard of with interest, and would like to see its working. He was so full of the Duchess, as he called her, that he forgot to tell us what she was duchess of.

"INTO THE SHOP YOU HULKING RUFFIANS"

However, next week up she drove at 3:30 of the clock in a 50-horsepower motor car. He had special China tea and cake that day. Bill carted her ladyship round and she read our motto and listened very attentively to Bill when he explained our financial position and showed how the afternoon tea was provided by a system of voluntary fines of the efficients who fell short of 100 per cent. by more than 3¼ points any week. Any efficient who surpassed 100 per cent. had his name inscribed on a roll of merit and it was wonderful how this pleased them. Even the women were pleased. Mrs. Robinson was heard to say that since the new system had got well under way Robinson had lost the habit of going to the Black Bull every evening. He generally fell asleep in his chair as soon as he got home.

When Lord Smallchin came round from the Hall to see for himself what all the talk was about, Bill showed him the efficients at work and explained how they derived their extreme efficiency from having had efficient fathers and grandfathers. It was Sam's habit to vault over his lathe instead of walking round the long bed. It saved time and enabled a hayrake to be sold for 3½ pence less loss, or more profit, which was the same thing to the world at large. Sam's father and grandfather had both worked on this lathe and this accounted for Sam's efficiency.

Lord Smallchin looked very pleased and turning to Bill said, "Evidently my g-g-good m-m-man you b-b-b-believe in the hereditary principle." Now Bill wasn't quite sure about this, but before he could pull himself together he found himself a member of the Primrose League.

As time went on the club room became quite well furnished by gifts of superfluous articles from the neighboring gentry and from the system of fines on the efficients. The parson's daughter presented a new motto in scarlet and silver: "A man must live." A fresh medal was struck for the efficients, bearing a figure of the sun with a serpent coiling up to it and the inscription, "Arduus ad Solem." This was my contribution suggested by an old college motto meaning "Continue to work harder." When the curate looked into the shop one day with a parcel of surplus slippers for the club's use he said it was a very honorable endeavor and it prompted him to offer a lecture one dinner hour on a Shakesperian text. This he read out in a resonant Oxford voice.

"The endeavor of this present breath may buy that honor that shall make us heirs of all eternity."

He pointed out that "Man must live" and it was better for him to live in comfort in the clubroom and exert himself in encouraging willing and efficient workers than it was to cumber up the shop space and return home dissatisfied with his inefficiency. The system as improved upon by us kept the drones out of the detestable workhouse.

He himself had failed in medicine and the law and had been turned out of the navy for talking of the blunt and the sharp ends of a ship. He proposed a vote of thanks to our cousin Stranger from across the pond who had risked the perils of the Atlantic and the discomforts of the "Mauretania" in order to fish over our wheel dam and dispense light and efficiency in a darkened land and pearls of wisdom in the sanded parlor of the Black Bull.

The Efficients Are Mysteriously Taken Sick

The day after election was kept as a holiday and we noticed with but little anxiety that all the efficients went off to the woods "to rest." They came home quietly enough.

Next day high-efficiency Sam declared he had sprained his back jumping over his lathe. Parker tripped up at his bench over a piece of 12x9x1¾-inch oak which was nailed to the floor as a left-foot packing piece. Stranger had had this wood so fixed because it added one-half of three-sixteenths per cent. to the efficiency of Parker when planing steel. Six men were suddenly taken ill with rheumatoid arthritis, declared by old Dr. Meredith to be due to long hours and overtaxed energies. The few other men went home just simply sick. Work was pressing. The Old Man was raving. The Committee of Inefficients sat all day in deliberation.

End of the Inefficient Club

On the second day of idleness the Old Man rushed in and kicked over the tea table and shouted "Into the shop you hulking ruffians!"

Down the stairs he drove us and we heard him turn the key in the lock and then saw it splash in the water behind the dam.

It was six weeks before the efficients were sufficiently well to return to work. In that time our white hands had regained their toilsome grime, only our nails appeared to mourn the past. Stranger and the Old Man had a terrible time of it in the Black Bull and Stranger left for other fields by the first train next day. When all had settled down into the semblance of peace the Old Man invited us all to dinner at the Black Bull. "Men" he said, "you all must live even if over 40. Each of you do your best but don't kill yourselves with hustle."

"There will be a fishing competition next Saturday afternoon in the mill pond. Worms only to be used for bait. Anglers and honest men will do their best endeavor." And that is how the system ended.

The only alteration visible in the shop when all was over was that the Old Man bought a horseshoe magnet and a brush and fetched 75-year-old Brown out of the workhouse and set him in an old tub chair to separate brass and iron filings, within sound of the shop and splash of the wheel which was old when Brown was a boy. The Old Man says with a twinkle in his eye, "A man must live and old Brown may as well sort filings for five bob a week as grizzle away in idle misery in an inhuman workhouse carried on upon scientific principles."

I forgot to say that the Old Man put up a notice in the shop which read, "Before you put a system into operation think out its effects to the end."

An Assembling Fixture for a Typebar and Pivot

By D. A. Charles

In Fig. 1 are shown a type bar *A*, and a pivot *B*, which are assembled in the fixture shown in Fig. 2. *C* is the ram of a punch press to which is attached the adapter *D* for holding the pillar subpress casting E. To the ram is screwed the bracket *F* which holds the feeding magazine *G* in which the pivots are loaded. At *H*, the magazine is cut away so the operator can see when it becomes empty. *I* is the punch or more properly speaking the die which is secured in the plunger casting. *J* is the table on which the bar is laid for assembling and *K* is a pad which descends with the down stroke of the press. A pivot is first dropped into the hole in the pad, and rests on the punch *L* which on account of economy in case of repairs is made short and is

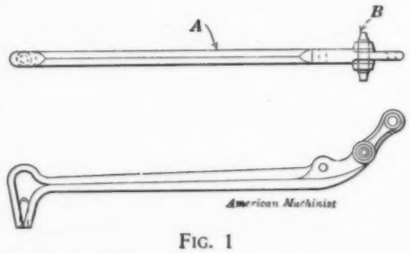


Fig. 1

backed up by a piece of drill rod *M*, and the screw *N*, by which the hight of the punch can be adjusted up and down.

The bar is laid on the table J with the hole directly over the pivot and when the ram moves down, the pad *K* is forced down, and the bar is forced down over the pivot, which is thus assembled into it. The assembled piece is then removed and the pin *O* releasing the spring *P*, removes the pressure of the pin *R* and allows another pivot to drop down into the hole, ready for the next bar.

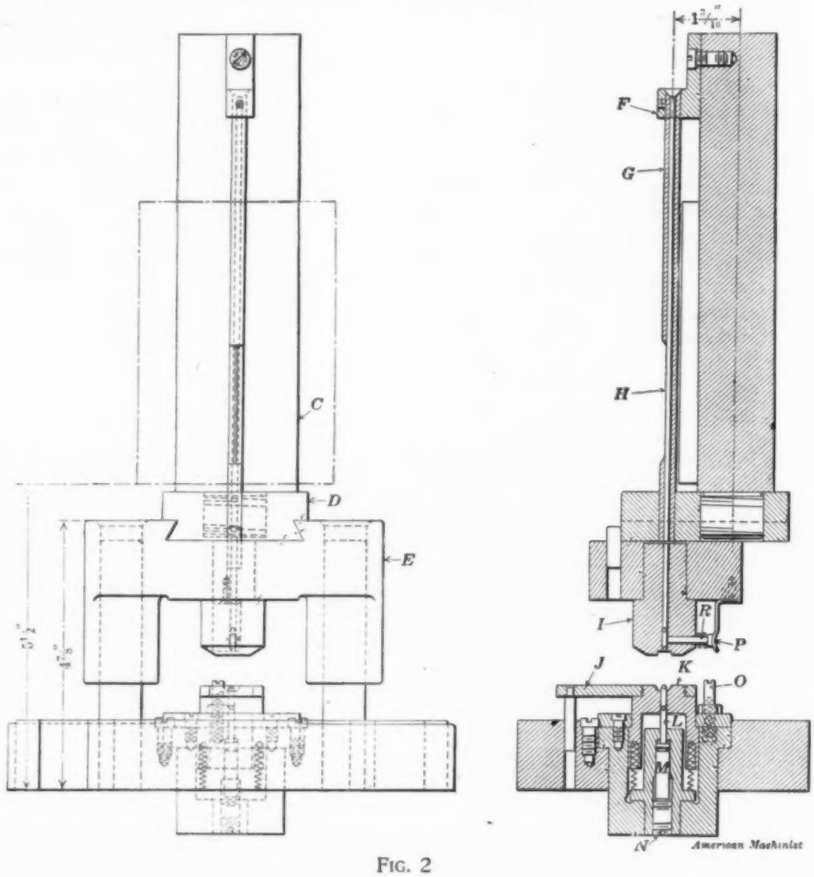


Fig. 2

Special Dies for the Edison Battery

By Ethan Viall*

The way the Edison storage-battery cells are clamped into the cases to prevent movement, and detail views of the punches and dies used for making the clamps.

*Associate editor.

The latest type of storage battery, made by the Edison Storage Battery Company, West Orange, N. J., is held in a crate or case used for convenience in handling, by sheet-metal hangers and hold downs or clamps, the making of which is purely punch-press work, and as such will be of interest to diemakers and pressmen in general.

At the left, in Fig. 1, four of the hangers are shown in place between the two lower side pieces of the case, while of the clamps, four are shown on the upper side piece, which is in place, and the other four on the detached piece lying in front of the case. A case with batteries and clamping pieces complete is shown at the right in the halftone, and in Fig. 2 one of the individual battery cells with its pair of clamps and hangers.

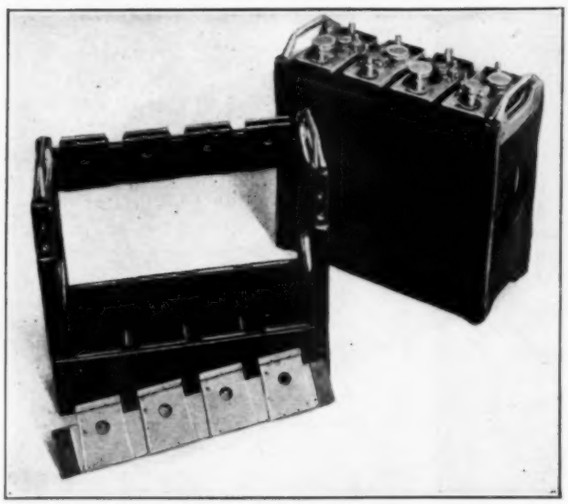


FIG. 1. AN EMPTY BATTERY CASE SHOWING POSITION OF CLAMPS; ALSO A COMPLETE CASE

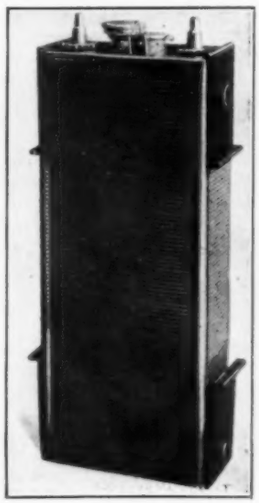


FIG. 2. CLAMPS AND HANGER IN PLACE ON A CELL

Fig. 3 shows the four stages in the development of hangers, which are made in several sizes for the various batteries manufactured, different sized, but otherwise similar, dies being used.

The hangers are first blanked out as at *A*, then the ends are turned up and the flanged holes formed as at *B*. These holes, as well as similar ones in the clamps, fit over pressed-metal plugs or projections on the battery cells and help keep them solidly in place in the cases. Next, the pieces are shaped as shown at *C*, and finally the top ends are formed box-like as at *D* on piece *E*.

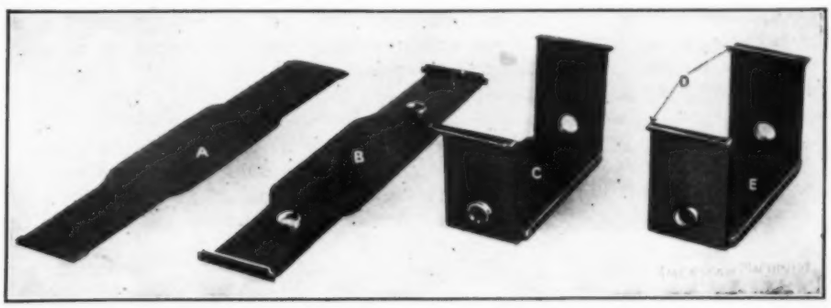


FIG. 3. STAGES IN THE EVOLUTION OF A BATTERY HANGER

HANGER-FORMING DIES

Taking the dies for forming the hanger, in order, the blanking die will not be shown as it is of the ordinary type, but the die for the second operation is shown in Fig. 4. The blank is laid on the die plate *A*, between the stops *B* and the side pieces *C*. On the stroke of the press, the two punches *D* pierce the blank, the punchings dropping down through the holes in the flange-forming dies *E*, and as the ram descends the sleeves *F* of the punches, which are backed by heavy springs, press the stock down on top of the dies *E*, preventing wrinkling or tearing as the flanges are formed by the further descent of the main body *G* of the punch, which presses down the spring-backed die plate *A*, at the same time forcing up the ends of the blank as at *H*.

In the third operation, the pieces just formed are placed in the die with the flanges and bent ends downward. As the ram descends the spring-backed parts of the punch *A* press the stock down on the top of *B*, holding it firmly and preventing

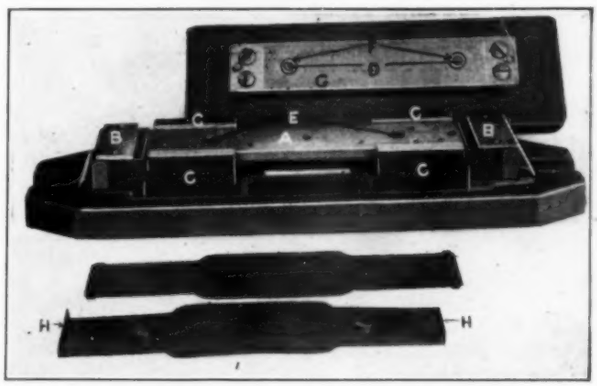


FIG. 4. DIE FOR TURNING UP THE ENDS AND FORMING THE FLANGED HOLES

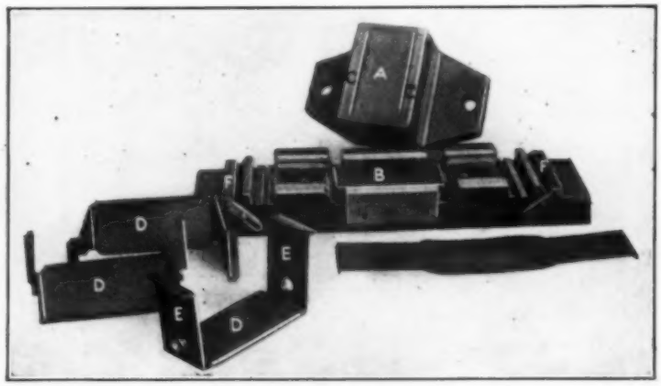


FIG. 5. DIE FOR SHAPING MAIN BODY OF HANGER

slipping or wrinkling as the outside portion *C* of the punch forces down the edges of the middle part of the blank, forming the shallow box-like part *D*, at the same time bringing up the ends as at *E*.

The parts *F*, shown on the die, are slipped over the solid end stops when forming shorter pieces for another size of battery cell and are not used for the pieces shown.

The last operation consists in bending the ends of the hanger into a long narrow box form, as shown at *D*, Fig. 3, which is done so that by sawing slots crosswise in the crate slats these ends can be fitted so as to prevent any movement sideways along the slats, and these ends are formed with the punch and die shown in Fig. 6, the details of which will be more clearly shown when we come to the description of the making of the clamps. In using this punch and die, the hanger is placed in the cradle and the bar *A* placed across the front. The punch then presses the "flaps" of the ends down around the piece *B*, which finishes the hanger. The pins *C* are simply spring plungers used as knock-out pins to throw the hanger up far enough to be easily removed.

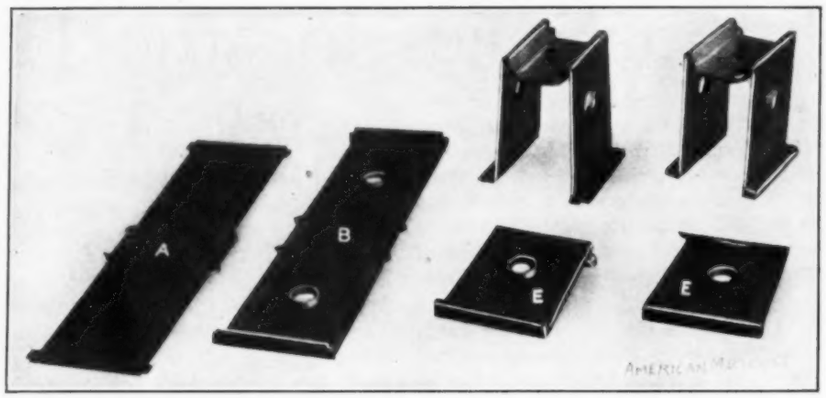


FIG. 7. STAGES IN THE EVOLUTION OF CLAMPS

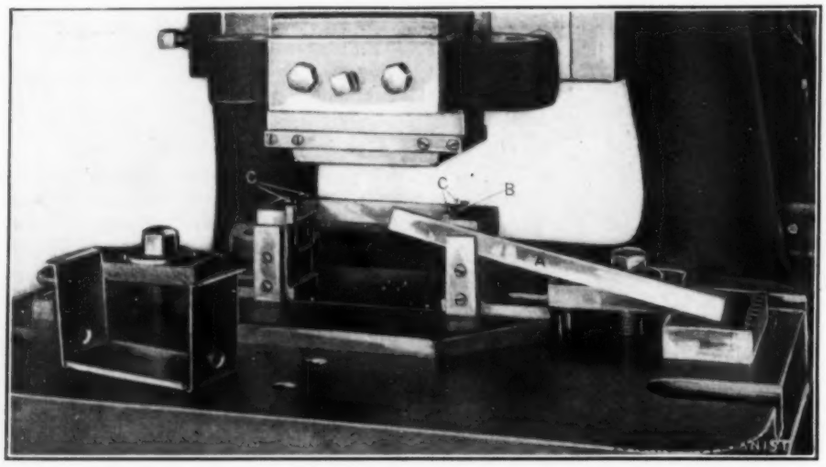


FIG. 6. SHAPING THE BENT ENDS

DIE FOR MAKING CLAMPS

Clamps are made in pairs in a manner very similar to that for hangers, but there is one additional operation, or five in all, the last being to divide the piece into two parts, the steps being shown at *A*, *B*, *C*, *D* and *E*, Fig. 7.

The dies shown in Figs. 8 and 9, are almost identical with those shown for similar operations on hangers, so they will not be further described.

Fig. 10 shows an end-forming die like the one shown in the press in Fig. 6, but a better view is given of the punch. The pieces *A* are backed by strong springs and recede into the body of the punch as it presses the ends of the clamps down around the forms *B*.

Fig. 11 shows the parting punch *A* and the die *B*. The double clamp is placed over the die and the punch cuts a piece out, leaving the parts as shown at *C*, the spring plate *D* acting as a stripper and ejecting the punching. The little recess *E* cut in the clamp, is to make room for the pole pieces on the battery top. The hook *F* is used to keep the stripper plate *D* in place when the die is not in use.

A RING DIE

The positive element of the Edison storage battery is contained in small tubes over which rings or bands are placed to prevent distortion, and these small bands are made ten at a time, in a

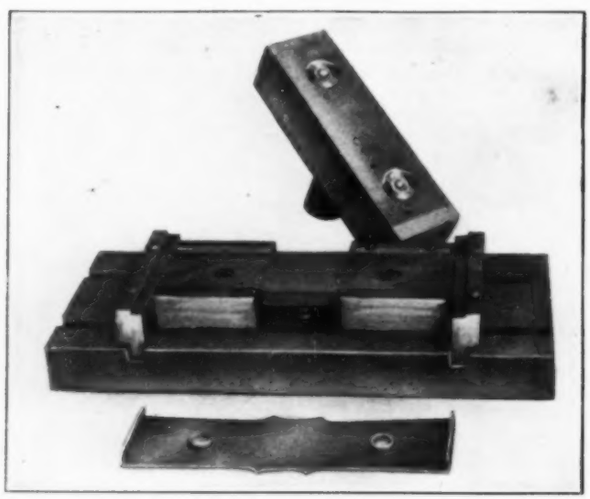


FIG. 8. END-BENDING AND HOLE-FLANGING DIE

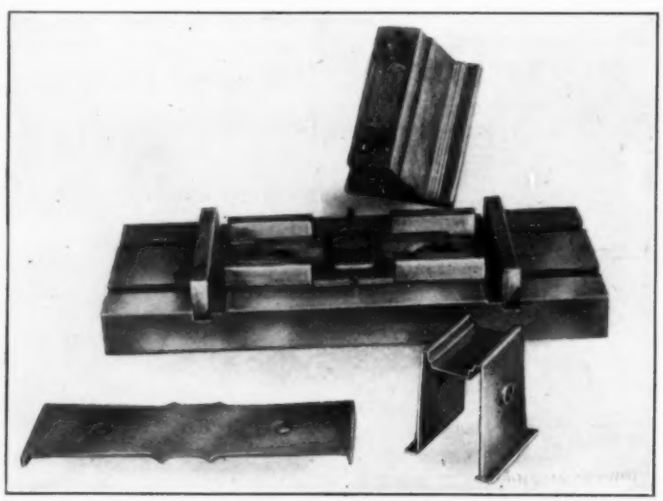


FIG. 9. DIE FOR SHAPING A PAIR OF CLAMPS

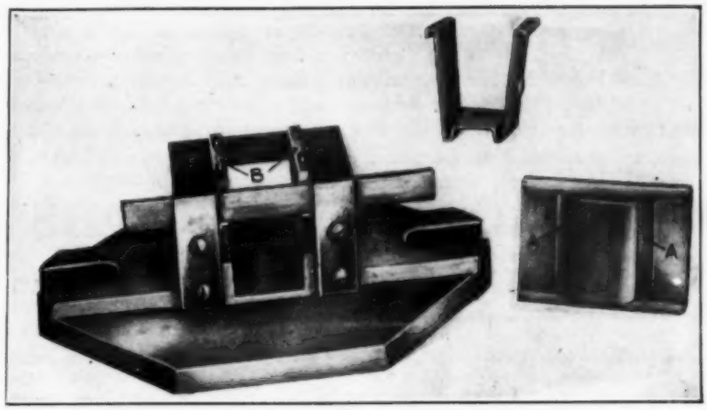


FIG. 10. DETAILS OF THE END-SHAPING DIE AND PUNCH

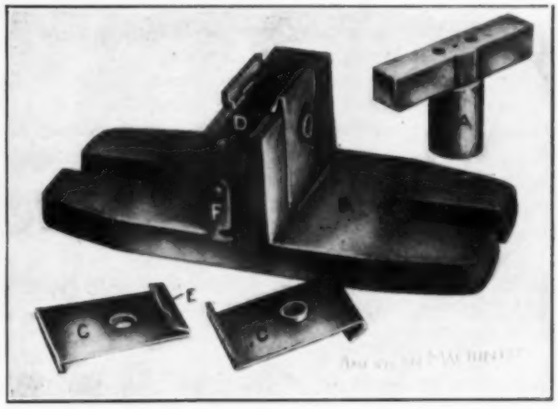


FIG. 11. THE PARTING PUNCH AND DIE

multiple punch and die shown in Fig. 12. In this halftone, *A* is the stock guide, *B* the die, *C* the punch *D* a pile of finished bands and *E* the stock from which they were punched.

Further details of this die are shown in Fig. 13, and, as this cut shows, 10 holes are first pierced in the stock which is then fed forward under a set of drawing punches, which force the stock downward, forming flanges which are cut off by sleeve punches, the resulting bands or rings dropping out of the bottom of the die. Referring to the sectional view of the die, *A* is one of the piercing punches and *B* one of the drawing punches, which are set into block *C*. As the ram descends, blocks *D* and *E* are forced up, closing the gap *F* and allowing *A* to pierce its hole and *B* to draw the stock down into the die in the shape of a flange.

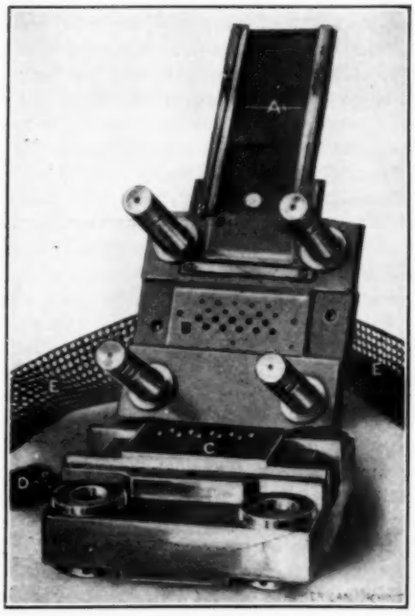


FIG. 12. DIE FOR MAKING RINGS FOR THE POSITIVE TUBES

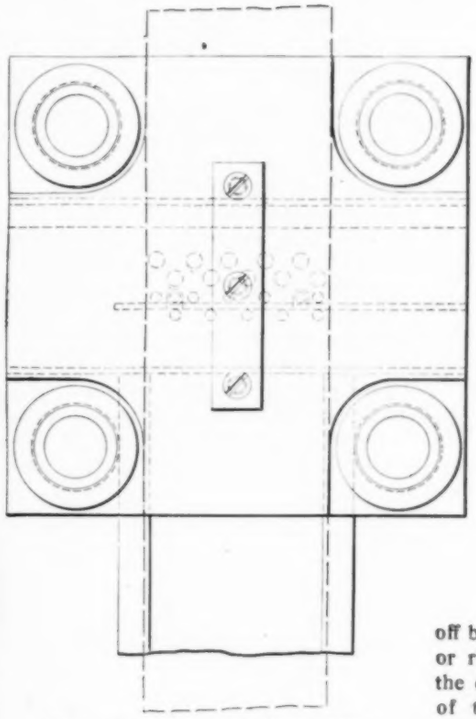
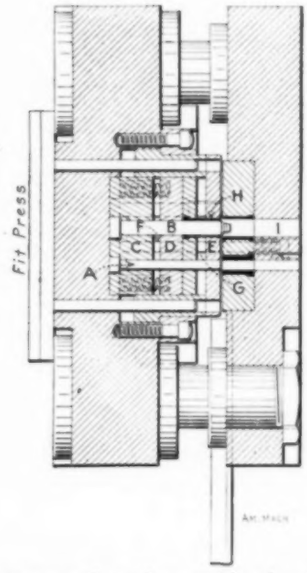


FIG. 13. DETAILS OF RING DIE



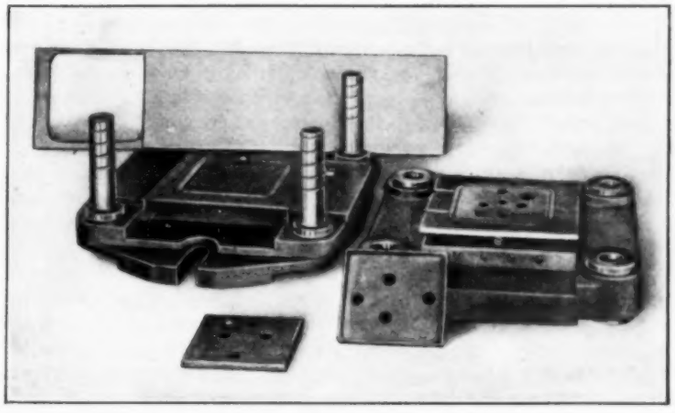


FIG. 14. DIE FOR MAKING BATTERY TOPS

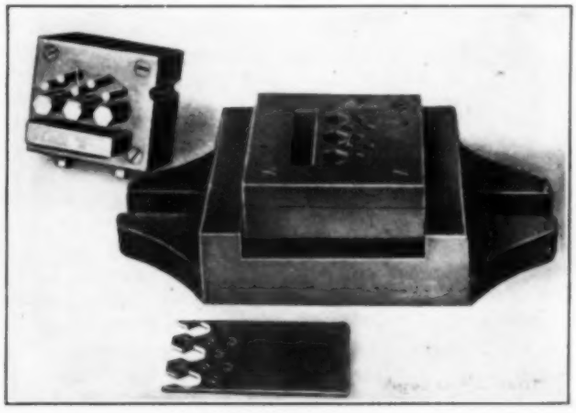


FIG. 15. PUNCHES AND DIE FOR MAKING FIVE NUTS AT ONCE

Further descent of the ram forces blocks *D* and *E* together, closing gap *G* and letting the sleeve punch *H*, which surrounds punch *B*, shear off the flange, thus making the ring which drops down through *I*.

Battery Top and Nut Dies

Fig. 14 is a punch and die for battery tops which is so similar to that described by E. M. Erb, on page 407, Volume 34, that it will not be further described here.

Fig. 15 shows the method of making five nuts at each stroke of the press. There are five small piercing punches, two pilots, three large blanking punches, and one long shearing punch, the action of which is too plain to need description.

Safety in Oxyacetylene Installations*

By Edwin H. White

Considerations in connection with the design and choice of suitable apparatus for oxyacetylene installations.

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Portability of equipment is a requirement in practically all wrecking work in which the cutting torch is employed and in many welding-repair operations in which it is necessary to take the equipment to the work rather than the other way around.

The higher cost of acetylene compressed in cylinders, and the uncertainty of supply because of transportation difficulties, makes portable acetylene equipment, as previously stated, a necessity and not a preference. A portable acetylene generator, to be safe, must be so designed that carbide cannot feed while the generator is being moved. In fact, its feed mechanism must be so designed that it connot feed carbide at a rate, under any condition, to raise the pressure much above that required at the blow pipe, i.e., 11 lb. at the outside. Thus we do away with the necessity for pressure relief valves and the possibility of the escape of gas in case of excessive pressure. A generator for portable purposes has been designed and will doubtless within a few months be put upon the market. The second requirement in a safe, portable acetylene generator is that it have a broad wheel base and low center of gravity. When these factors are properly worked out it is practically impossible to upset the equipment, even though one side of the truck be raised two feet from the floor level.

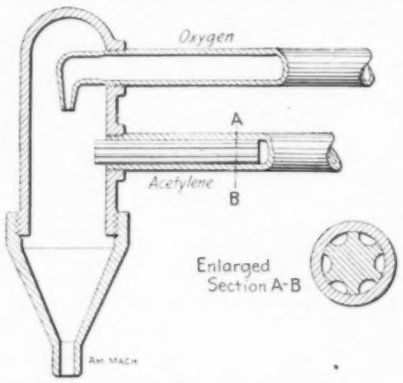
One fact must be made plain here, that in the low-pressure blow pipe it is the acetylene that is under low pressure, the oxygen being usually under from 12 to 60 pounds per square inch in welding, and from 30 to 175 pounds in all cutting excepting the heaviest thicknesses, in which the pressure is even higher.

In the high-pressure type of torch it is the acetylene that is under high pressure, which pressure incidentally is not high, being from 6 to 15 pounds at the generator and from 6 to 10 pounds at the blow pipe. In the high-pressure type of blow pipe the oxygen is under comparatively low pressure—from 6 to 12 pounds in welding. In cutting the oxygen pressure would be the same in one type as in the other.

From the standpoint of safety, and in certain directions from other standpoints also, the high-pressure type of torch is most in favor, the reason for which is made apparent in consideration of possibility of back pressure.

Back Pressure

Since oxygen is always under a higher pressure than acetylene, it is apparent that in case of the blow pipe's nozzle becoming stopped up, as, for instance, with a splash of hot metal, the oxygen would back the acetylene down through the acetylene line, and if not arrested there would be an oxygen and acetylene mixture in the acetylene generator. There is no hazard in this in itself excepting that should the oxygen be used at very high pressure it might, on reaching the acetylene generator, severely strain if not burst it. It is for this reason that all good installations are supplied with a back-pressure valve, which is placed between the generator and the acetylene line, so that should back pressure occur the mixed gases would be vented out of doors on reaching the back-pressure valve.



Acetylene Pipe Fitted with an Inner Tube

The stoppage of a nozzle is an extremely rare occurrence in welding work, and much more liable to occur in cutting. But as a matter of every-day precaution, no oxy-acetylene installation should be considered complete without the installation of a well designed back-pressure valve, which, for obvious reasons, should operate upon the hydrostatic principle, and should vent out of doors.

Referring back to high- and low-pressure torches and remembering that the low-pressure torch employs oxygen under a higher pressure than does the high-pressure torch, it is apparent that in the case of the blow pipe's nozzle becoming stopped up, a mixture of oxygen and acetylene will take place more quickly in the high-pressure type, and would extend further in a given interval of time.

Flash-back or Fire-back

Let us suppose that an operator has stopped up the nozzle of his torch and that back pressure has occurred and been relieved at the back-pressure valve. We must not forget that the release of gas in the back-pressure valve ceased when the pressure became equal to that of the acetylene from the generator. Therefore, after an occurrence of back pressure, the free space in the back-pressure valve and the entire acetylene line is full of an oxygen-acetylene mixture.

Now in normal operation, the velocity at the blow pipe's nozzle is faster than the rate of ignition of the mixture, whereas on resuming work, after back pressure has occurred, the operator is liable to open his torchcock only a little way, in which event the velocity of the gas may be less than the rate of ignition, and if this be so, an attempt to ignite the torch will cause a flashing back clear through the acetylene line and to back-pressure valve. That is, unless means are provided to prevent the occurrence.

There are three preventives of flash-back. One is the employment of several successive layers of fine-mesh brass or bronze screen in the acetylene pipe of the torch, which arrests flame on the same principle as the Davy miner's lamp. Another preventive is the introduction of a fitted piece of pumice stone in the acetylene pipe of the torch. Flame or spark cannot pass through it. A third preventive consists in having the acetylene pipe fitted with an inner tube, as shown in the accompanying sketch, Fig. 1, by which, in effect, the acetylene is passed through many restricted tubes, it being claimed that acetylene and oxygen cannot be made to mix in a restricted tube, or a multiplicity of them, of the diameter shown, and that therefore, even though back pressure occurs, there can be no mixture

of oxygen and acetylene, the oxygen merely pushing back pure acetylene while the back pressure is in progress, and on the relief of same the acetylene from the generator then pushes back pure oxygen, neither of which unmixed with the other can explode.

The last-named method of prevention apparently has the best of the argument, in that a restricted tube imposes a physical condition against the mixture of the two gases, whereas the other preventives must be occasionally cleaned and renewed, and if, after removal, are not replaced, the space occupied by them becomes a mixing chamber on the next occurrence of back pressure. For the restricted-tube preventor it can further be argued that the operator cannot eliminate it; because even though he take it out for cleaning he must replace it in order to reassemble his torch if the design be right, into operating condition.

Oxygen Supply

There are two means of securing oxygen, one, the purchase of it compressed in cylinders, and the other, generating it on the premises. In point of safety the two methods are doubtless of equal merit. The oxygen-storage cylinders most employed are of seamless steel, annealed and tested hydraulically to a pressure of 3600 lb. per square inch. The pressure of the oxygen in this type of cylinder, when full is 120 atmospheres. Inasmuch as the oxygen in these cylinders is practically pure, and since, moreover, it is under high pressure, the corrosive action is very rapid as compared to the action of oxygen in the atmosphere. Hence, it is the best practice, and a proper precaution, to have such cylinders re-annealed and tested every two years.

Of the generating systems, the one best known at the present time is that employing chlorate of potash mixed with manganese dioxide, which materials are heated in a retort. In some installations employing the chlorate method, the oxygen is generated under pressure—from 50 to 150 pounds per square inch. Still another type of chlorate-oxygen plant generates the oxygen at practically no pressure. A compressor is employed to compress the gas into cylinders, the usual pressure in the cylinder being 300 pounds per square inch. Such cylinders are seldom, if ever, of the seamless steel type, being usually made of sheet metal tested to between 600 and 800 pounds to the square inch. In the matter of safety, the question naturally arises, which is the better—to run the oxygen generator at the pressure above stated without storing the gas, or to run it at little or no pressure and afterward compress it, as previously noted.

In the chlorate of potash method of generation, there is a hazard not generally understood, in that the gas as generated is rich in chlorine, requiring for its elimination care on the part of the operator in keeping his purifying solution up to efficiency. Obviously there is a point at which the solution has absorbed all the chlorine it can.

The following quotation from Lewes makes this hazard clear: "When acetylene is brought into contact with chlorine gas, instant explosion takes place, accompanied by a large red flame and the deposition of much carbon; and these effects readily take place in the dark and are, of course, quite independent of the action of the sun's rays or of light."

In view of this fact and assuming an escape of oxygen and chlorine from the oxygen generator taking place simultaneously with an escape of acetylene from the acetylene generator, there would be a result not pleasant to think about.

A third generating system employs a material known as Lavosite, which gives off oxygen when brought into contact, within the apparatus, with water at 190 degrees Fahrenheit. Manufacturers of this system state that no chlorine is present in their oxygen, and that the gas to be pure needs but to be passed through a column of water.

Installation of Generating Equipment

As will be seen from the foregoing, it is a wise rule on the part of the National Board of Fire Underwriters to specify the installation of acetylene and oxygen generators in separate rooms, with doors between which will be closed by a spring whenever opened. It is almost certain that there will come a time in every installation when there will be an escape of either oxygen or acetylene, or of, perhaps, both, and the right proportion of oxygen and acetylene, if ignited, will surely produce disastrous results. Especial care should be given the installation of the acetylene generator. First and foremost, the drain through which the residuum is discharged should be fitted with a siphon, for the reason that the residue is heavy and even though the drain had a considerable pitch the residue, unless a syphon is employed, will gradually build up, causing stoppage of the drain. This would mean flooding the floor of the generating room on opening the flush-out gate of the generator. Supposing that in this flooded condition the operator should upset a can of carbide. Instant generation of a large volume of gas would take place, and should there happen to be an open jet or other flame within a reasonable distance, there would be trouble.

The second and important requirement in the installation of an acetylene generator is that there be plenty of space above the top of the hopper for filling with carbide, and the funnel through which the carbide is poured should be fitted with a slide, so that no carbide will be dropped on the floor should the operator not notice when his hopper is full, and in that way have carbide to put back in the carbide can from the funnel. The slide should be fitted into the lower end of the funnel, so that the opening can be closed should the hopper be over-filled. The general rules covering installation which are published by the National Board of Fire Underwriters, at Chicago, Ill., should be followed. Installation in accordance with these rules should be one of the specifications given by the purchaser of equipment.

The Underwriters' Rules

Following are such of the underwriters' rules as are of importance in correct installation.

1. Foundations.

a. Where practicable, to be of brick, stone, concrete or iron. If necessarily of wood, they shall be extra heavy, located in a dry place and open to the circulation of air.

The ordinary board platform is not satisfactory. Wooden foundations shall be of heavy planking, joists or timbers, arranged so that the air will circulate around them and so as to form a firm base.

b. To be so arranged that the machine will be level, and unequal strain will not be placed on the generator or connections.

2. Location.

a. Generatofs should preferably be placed outside of insured buildings in properly constructed generator houses.

b. Generators should be so placed that the operating mechanism will have ample room to work in and so that attendant may reach the various parts and perform his required duties without hindrance or need for artificial light. They must not be subject to tampering by unauthorized persons, and where necessary should be provided with an inclosing partition which will not interfere with the proper ventilation of the room.

c. Generators to be amply protected against freezing.

3. Escapes or Relief Pipes.

Each generator must be provided with an escape or relief pipe of ample size; no such pipe to be less than three-quarters inch internal diameter. This pipe shall be substantially installed, without traps, and so that any condensation will drain back to the generator. It must be carried to a suitable point outside the building, and terminate in an approved hood located at least twelve feet above ground and remote from windows.

The hood must be constructed in such a manner that it cannot be obstructed by rain, snow, ice, insects or birds.

4. Capacity.

Generators to be of sufficient capacity to furnish gas under working conditions from one charge of carbide to all blowpipes or torches installed, for at least one working period of five hours. For

carbide feed machines for this service the rating may properly be one cubic foot of gas per hour, per pound of carbide, whereas with water feed machines the rating should not be more than one-half the above.

b. Where installed in factories which run at night, generators should be of sufficient capacity to avoid the necessity of recharging at night.

5. Carbide Charges.

To be sufficient to furnish gas continuously for the maximum operating period to all blow pipes or other appliances installed. In determining charges, lump carbide to be estimated as capable of producing 4½ cubic feet of gas to the pound, commercial ¼-inch carbide 4 cubic feet of gas to the pound, and intermediate sizes in proportion.

6. Piping.

a. Connections from generators to service pipes should preferably be made with right and left couplings or long-thread nipples with lock nuts. Where unions are used these should be of a type which obviates the necessity for using gaskets.

b. Piping, as far as possible, to be arranged so that any moisture will drain back to the generator. If low points occur of necessity in any piping, they should be drained through tees into drip cups permanently closed with screw caps or plugs. No pet-cocks to be used.

c. A valve and by-pass connection to be provided from the storage reservoir to the blow-off for removing the gas should it be necessary to do so.

d. The schedule of pipe sizes for piping from generators to blow pipe should conform to that commonly used for ordinary gas, but in no case must the feeders be smaller than three-eighths inch.

The following schedule is advocated:

¾ inch pipe,	26 feet long,	2 cubic feet per hour
½ inch pipe,	30 feet long,	4 cubic feet per hour
¾ inch pipe,	50 feet long,	13 cubic feet per hour
1 inch pipe,	70 feet long,	27 cubic feet per hour
1¼ inch pipe,	100 feet long,	50 cubic feet per hour
1½ inch pipe,	150 feet long,	65 cubic feet per hour
2 inch pipe,	200 feet long,	125 cubic feet per hour
2½ inch pipe,	300 feet long,	190 cubic feet per hour
3 inch pipe,	450 feet long,	335 cubic feet per hour

e. Machines not to be directly connected to sewers, but should discharge into suitable open receptacles, which may be connected to the sewer.

f. Piping to be thoroughly tested when system is completed. It must not show loss in excess of two inches of mercury within twelve hours when subjected to a pressure equal to a column of fifteen (15) inches of mercury.

g. All installation work to be done by persons experienced in the erection of acetylene apparatus.

7. Care and Attendance.

a. Generators should be cleaned and recharged at regular stated intervals. This work should be done during daylight hours only and likewise all repairs should be made at such a time that artificial light is not needed.

Note—Where installations are so located that artificial light is absolutely necessary, this must be provided by incandescent electric lights inclosed in gas-tight globes, equipment to comply with National Electrical Code.

b. In charging generating chambers clean all residuum out thoroughly and be sure that no drain or other pipe has become clogged. Generators should then be filled with the required amount of water. In charging carbide-feed machines be careful not to place in the generator less than one gallon of water for each pound of the carbide capacity, and not to bring the water above the point marked on the machine as the proper level. Charge with carbide only when generating chamber is filled with water.

c. Always keep seals and tanks filled with clean water. Carefully guard against the escape of gas.

Never recharge with carbide without first cleaning out the generating chamber and completely refilling with clean water.

Never test the generator or piping for leaks with a flame, and never apply flame to any open pipe or at any point other than the blow-pipe tip.

Never use a lighted match, lamp, candle, lantern, or any open light near the machine.

Failure to observe the above cautions is as liable to endanger life as property.

8. Outside Generator Houses.

a. Outside generator houses should not be located within five (5) feet of any opening into, nor have opening toward any adjacent building, and should be kept under lock and key.

b. The dimensions to be no greater than the apparatus requires to allow convenient room for recharging and inspection of parts.

c. Generator houses to be thoroughly ventilated, and any artificial heating necessary to prevent freezing to be done by steam or hot-water systems.

A Time Study under the Taylor System

By H. W. Reed

The most glaring error committed by a new time-study man is the too early use of his stop watch. Certain elements enter into the work, which must be settled before the actual time is recorded.

First, the elimination of all unnecessary, dangerous and disagreeable elements. Humanity should be placed on a higher plane than mere increased production. Following this view the physical welfare of the operator comes first. One must bear in mind that the results derived from a time study should benefit not only the employer but also the employees. To secure the maximum benefits for both, the operator must be freed from all mental anxiety in regard to his personal safety, and the operation relieved of all possible repulsive features. This may mean a monetary outlay at the start, but the returns will prove that it is a paying investment.

Second, the proper tools for the operation.

Once the time is recorded there should be no conjecture as to the possible production had a different combination of tools been used. This must be settled at the start, either from past experiments or by trial comparisons. When the time is once recorded one must feel that it represents the actual time and the best tools available. If the operation is on a machine the speeds, feeds and depth of cuts can be figured by slide rule. The results obtained in this manner are used as a basis to build up the entire operation.

Third, the correct method of operation.

This represents the so called "motion study." The best results can be obtained only by close observation of the workman while performing the operation. The rearrangement of the sequence of elements in the operation will, very often, be beneficial. A close study of the operation will bring to light the unnecessary movements, and also which elements, if any, could to advantage be separated into two or more separate parts. When a movement becomes too complicated, better results can be derived by simplifying it by separation.

When the preparatory basis has been settled and the operator feels that he has "the one best way," the actual recording of time can be considered.

The point the observer should never forget is to get the correct time for each element regardless of the total time consumed. Certain elements will enter into a thousand operations and once the actual minimum time is found for these separate elements they can be classified and filed, thus permitting the use of the standard elements in the future without an actual time study.

For example: The standard time required to select a twist drill with a No. 4 shank, read the size stamped on it, put the drill in the spindle, and press it firmly home consumes 0.27 of one minute. This time should be used in setting the rate for every operation requiring a drill of this size. Get the correct individual time and the total time to be allowed can readily be calculated. The percentage of allowance for each operation will take care of the varying conditions under which the element is performed.

Get the Operator's Co-operation

It is a very good policy to consult both the foreman and the operator on all questionable points on the operation. This incorporates them in the time study instead of making them antagonistic to it.

Treat the operator as a human being, gain his confidence and keep it, for let the integrity of the observer be questioned and his usefulness in this line of work is at an end.

Give the operator the benefit of every doubt, don't try to drive or harass him. Under the best conditions it is difficult to get the correct time, time that can be used for different operations, and by wilfully antagonizing him the observer is stirring up trouble for years to come.

Let everything be open and above board. I have found the average mechanic to be honest; he will only deceive the observer when he feels that he is not getting a square deal. By treating a man as a man and increasing production by scientific methods and not by slave driving the best results can be obtained.

The study submitted herewith is part of an assembling operation, chosen on account of its simplicity, so that it might readily be understood. (The individual time is taken from the continuous time after the study is made and from the individual time the minimum is picked out.)

BP1

OBSERVATION SHEET

OBSERVER'S NAME Reed MACHINE NO. Vise DATE July 7, 1911

WORKMAN'S NAME AND QUALIFICATIONS Hamilton (good)

PIECE Assembling hose and fitting (¼ ell) Drawing 7293

Detail Operations	1 Continuous Time	1 Individual Time	2 Continuous Time	2 Individual Time	3 Continuous Time	3 Individual Time	4 Continuous Time	4 Individual Time	5 Continuous Time	5 Individual Time	6 Continuous Time	6 Individual Time	7 Continuous Time	7 Individual Time	8 Continuous Time	8 Individual Time	9 Continuous Time	9 Individual Time	10 Continuous Time	10 Individual Time	Minimum Time
Pick up ell, put in vise	0.06	0.06	0.63	0.06	1.17	0.06	1.73	0.07	2.20	0.05	2.82	0.08	3.28	0.06	3.79	0.05	4.31	0.08	4.75	0.06	0.05
Pick up hose and hose clip	0.09	0.03	0.67	0.04	1.21	0.04	1.75	0.02	2.22	0.02	2.85	0.03	3.31	0.03	3.81	0.02	4.33	0.02	4.79	0.04	0.02
Dip end of hose in turpentine	0.12	0.03	0.70	0.03	1.25	0.04	1.78	0.03	2.25	0.03	2.89	0.04	3.34	0.03	3.85	0.04	4.37	0.04	4.82	0.03	0.03
Slip hose clip on end of hose	0.14	0.02	0.72	0.02	1.27	0.02	1.82	0.04	2.29	0.04	2.91	0.02	3.37	0.03	3.90	0.05	4.39	0.02	4.84	0.02	0.02
Put end of hose on nipple	0.20	0.06	0.81	0.09	1.35	0.08	1.93	0.11	2.36	0.07	2.99	0.08	3.50	0.13	3.99	0.09	4.46	0.07	4.89	0.05	0.07
Pick up screwdriver	0.23	0.03	0.83	0.02	1.38	0.03	1.96	0.03	2.38	0.02	3.01	0.02	3.52	0.02	4.01	0.02	4.48	0.02	4.93	0.04	0.02
Tighten hose clip	0.52	0.29	1.07	0.24	1.62	0.24	2.10	0.14	2.69	0.31	3.18	0.17	3.67	0.15	4.18	0.17	4.63	0.15	5.11	0.18	0.15
Lay down screwdriver	0.54	0.02	1.08	0.01	1.63	0.01	2.12	0.02	2.71	0.02	3.19	0.01	3.69	0.02	4.19	0.01	4.65	0.02	5.13	0.02	0.01
Loosen vise, put hose on bench	0.57	0.03	1.11	0.03	1.66	0.03	2.15	0.03	2.74	0.03	3.22	0.03	3.74	0.05	4.23	0.04	4.69	0.04	5.16	0.03	0.03
																					0.40
																	30% on handling time				0.12
																	Total time for one piece				0.52

SPECIMEN RECORD OF A TIME STUDY OF AN ASSEMBLING OPERATION

It will be noticed that the extreme maximum is not always taken. An error of reading the watch or in catching the start of a movement may show one element of time much lower on one piece than on any of the others, and it would be unfair to claim this as the minimum.

The sum of these minimums is the shortest possible time in which the operation can be finished on one piece. To this a percentage of allowance must be made. A human being is not a machine; regardless of the number of times the operation is repeated the time will vary. The study sheet shows the actual time put in on the operation. No operator could keep this pace up throughout the day, so a percentage for fatigue should be added.

ALLOWANCE FOR FATIGUE

The amount to allow is based on each operation. On average machine-shop work it varies from 20 to 80 per cent. for handling time and a flat 10 per cent. for actual machine time. This latter is for slippage of belts and errors of machine speed.

The allowance for handling time can be divided into five primary classes:

Weight of material; degree of accuracy required; number of elements in the sequence; position of operator while working; variety of elements in the sequence.

I have found that when a working man is under a heavy physical strain throughout the day, or should the work be extremely accurate, the 80 per cent. allowance is necessary. On the other extreme, machine painting, light rough work, or where a sequence of operations are few in number and after performing them a few times the operations become mechanical, from 20 to 30 per cent. is all the allowance required.

On the sample sheet 30 per cent. was considered fair; from checking up this operation several times I have found this allowance to be correct.

The successful observer must be fair to both employer and operator. He should not ask the workman to do what he would refuse to do were the conditions reversed, but once convinced that the minimum time is correct he must have the necessary backbone to uphold his report and insist that the time allowed must be made.

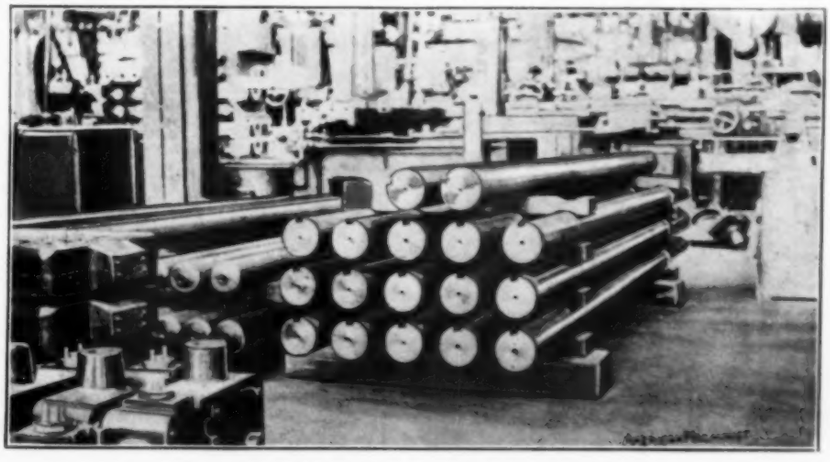
Racks for Finished Bars

The problem of storing finished or semi-finished spindles while waiting for the assembling, is solved in many different ways. The illustration shows the plan used by the Lucas Machine Tool Company, of Cleveland. Strips of 1½x3-inch wood are cut about 2 feet long and notched in five places with a rounded groove, as can be seen. These grooves are of different sizes, according to the size of bars to be held.

By laying two of these strips on timbers to keep them off the floor, the first five spindles are laid in the grooves, another strip laid on top of the bars and the next five laid in place.

This makes a very simple method of piling work of this kind with perfect safety to both the work and the men and would seem to have many applications.

The three sizes are painted different colors and shows at a glance which piece to use for the different-sized spindles.



CONVENIENT METHOD OF STORING FINISHED BARS

Broaching Machine for Boring Tools

By M. E. Hoag

Interesting broaches and broaching machines designed for use in making expansion boring tools.

A fixture that broaches out a hole in 30 minutes that formerly required 15 to 20 hours' hand filing.

The Mathews-Davis Tool Company, of St. Louis, Mo., in the manufacture of a line of expansion boring tools for various kinds of work, use some very interesting broaches and broaching machines of their own design.

Fig. 1 shows a special fixture applied to a Hendey miller for cutting broaches. As the teeth of these broaches are *undercut* at an angle, a fixture is required that has a wide range of adjustments; this is accomplished very satisfactorily by the one shown.

It will be observed that the base can be tilted and swiveled in any direction, and the broach holder can be raised or lowered as required, while the heavy overhanging arm supports the special arbor and cutters.

At the time I visited these shops this fixture was in operation. It completed three teeth on a high-speed steel broach, similar to the one shown, at one cut.

The broach holder is graduated, and has pin holes suitably located, so that when one cut has been completed, the work can be advanced the right distance for the next three teeth.

Fig. 2 shows a few of the 112 different broaches used in these shops, *A A* being used to broach the ends of the slots and *B B* for the sides.

In Fig. 3 is seen a very interesting broaching or filing fixture applied to a Barker & Chard shaper, with one of the broaches and the work in place.

The broaches are slipped over the ½-inch studs at the ends of the fixture and held in place by standard nuts. The pivoted holder at *B* allows for any slight variation in the length of broaches, and by tightening the nut indicated by the arrow the required tension is put on the tool.

This fixture will broach out a hole in 30 minutes that it formerly required from

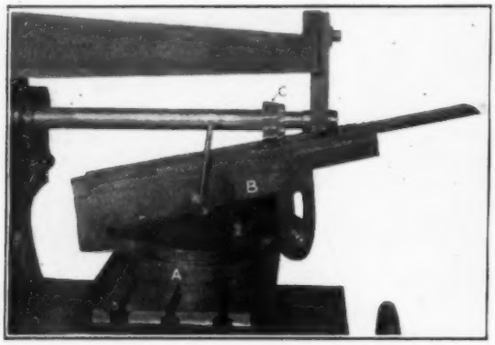


FIG. 1. A SPECIAL FIXTURE ON A HENDEY MILLER

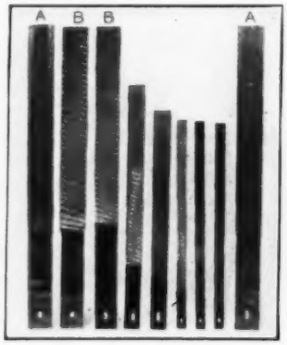


FIG. 2. A FEW OF THE BROACHES

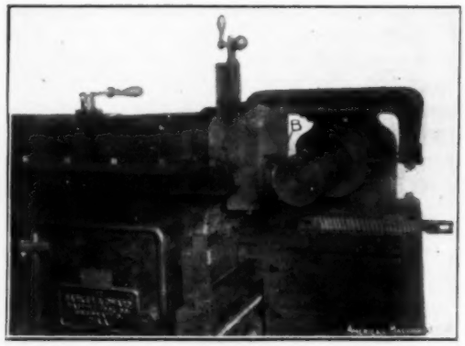


FIG. 3. ONE OF THE BROACHES AND WORK IN PLACE

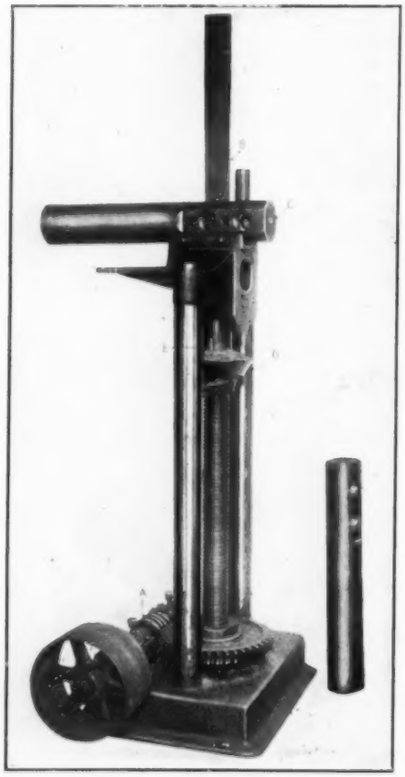


FIG. 4. VERTICAL BROACHING MACHINE

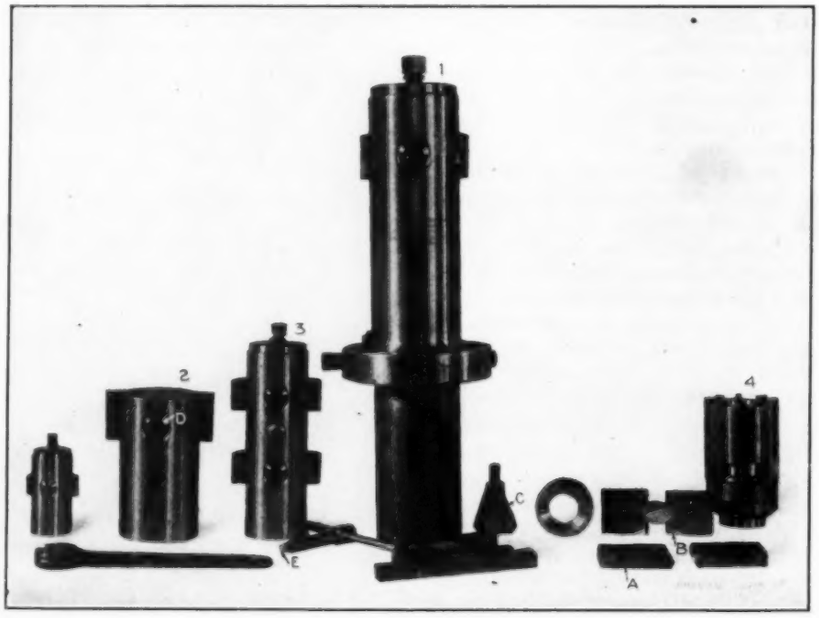


FIG. 5. THE TOOLS MADE

15 to 20 hours to file out by hand with the same degree of accuracy.

Fig. 4 shows a very powerful vertical broaching machine designed by Emery E. Davis, vice-president of the company, and built in their own shops.

This machine is used not only on the heavy work shown in the cut, but on smaller work as well. The large work is first drilled out in a special drilling fixture; the smaller pieces are drilled and milled in a Pratt & Whitney spline miller, after which they are finished with four broaches, a rougher and a finisher being used for both the ends and sides of the slots, thus completing the work with a great degree of accuracy. Standard sizes are maintained to within 0.0001 inch on this work.

With this machine, a ⅞x3-inch slot is broached, removing 1/16 inch of metal at one pass of the cutting tool, at an expenditure of about one horsepower.

In operating this machine, the work is first placed in the V-blocks and held down by a suitable clamping device, not shown in the cut. The broach is passed through the work from above and connected to the end of the screw by the taper key or drift *E*. In this machine there is no keyway in the broach holder as in most other machines of this kind; but, instead, keyways are cut the full length of the uprights, and they fit keys in the ends of the cross arm seen just above the chip tray *D*. This feature is quite important, as it insures perfect alinement throughout the entire length of the stroke.

The machine is driven by a 6-inch belt, through the worm and worm gear *A*. The screw is operated by a bronze nut 10 inches long, which extends through the hub of the worm gear. The collar seen just above the gear serves as a lock nut to take up end play. Suitable housing covers the worm and gear when the machine is in use. A gear ratio of 42 to 1 makes the machine very powerful. A saving of 95 per cent. in cost of broaching operations has been made by this machine over former methods.

In Fig. 5 are shown some of the tools manufactured by this company, and they give a fair idea of the wide range of work for which they are suited.

The large tool No. 1 is for boring car-wheel centers; No. 2 is especially adapted for boring gasolene-motor cylinders, or similar work that requires a bottomed hole. No. 3 is a double tool used for taking a roughing and finishing cut at one setting. No. 4 is a special expanding reamer this company is putting on the market.

In Fig. 5 the small parts *A* and *B* are cutters, *C* is the hardened-steel wedge that operates the cutters, and *D* (No. 2) is the graduated nut by which adjustments are made.

The main features of these tools are the high degree of accuracy maintained in their construction, and the fact that adjustments can be quickly made to within less than 0.001 inch. Hence the same tool can be used for both roughing and finishing a hole by simply turning the adjusting nut *D* the required number of thousandths with the wrench *E*.

Method of Deriving Formulas for Use in the Design of Whip Cranes

By H. W. Crane

The crane shown in Fig. 1, which was mounted near the top of a blacksmith-shop punch, was made from a round bar of machine steel with very little forging

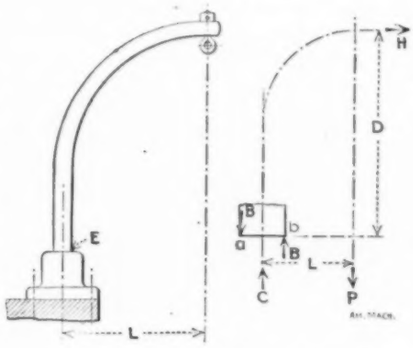


Fig. 1. The Crane

Fig. 2. Diagram of Moments

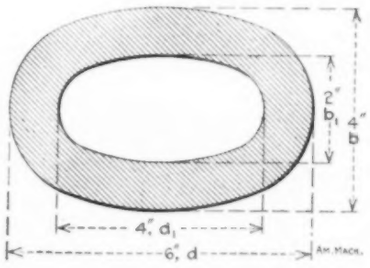


Fig. 3. Support Section

to change its section. However, it has a flat spot near the end where the bolt is shown. The greatest unit stress occurs at *E*, where the combined compressive stresses, due to both the bending moment and the direct pull of load *P* are located.

Fig. 2 shows a free section near *E* of Fig. 1. Here equilibrium is established by the couple $B \times a\,b$ and force *C* due to direct load of *P*. The moment $H \times D = P \times L$. Therefore, the compressive stress *B* is in the same condition as in a cantilever of moment $P \times L$.

Let

S = Combined unit working stress at point *E*

C = Compressive unit stress due to direct load *P*

B = Compressive unit stress due to bending moment $P \times L$

A = Area of section at point *E*

Z = Section modulus.

Then

$$S = C + B, \text{ or } B = S - C;$$

$$C = \frac{P}{A}, \text{ or } B = S - \frac{P}{A};$$

and

$$PL = BZ.$$

By substitution,

$$P = \frac{SZA}{LA + Z}, \qquad (1)$$

and

$$S = \frac{P(LA + Z)}{ZA}. \qquad (2)$$

Formulas (1) and (2) are for use in the design of any section.

For Circular Sections

For a circular section, which is the one most likely to be used on this style of crane,

$$Z = \frac{d^3}{10};$$

and

$$A = \frac{\pi}{4} \times d^2,$$

where *d* equals the diameter of the section. Substituting these values in (1) and (2) gives,

$$P = \frac{\pi S d^3}{10\pi L + 4d^3}, \qquad (3)$$

and

$$S = \frac{4Pd + 10\pi PL}{\pi d^3}. \qquad (4)$$

Let Fig. 1 be a cast-iron support ($S =$ 2000 pounds) with a section as shown in Fig. 3. To find the safe load, where $L =$ 30 inches, using formula (1).

From any of the handbooks,

$$A = 0.785(bd - b_1d_1) = 7.85 \text{ square inches}$$

$$Z = \frac{bd^3 - b_1d_1^3}{10d} = \frac{26}{3}.$$

Substituting in formula (1), $P = 557$, the safe load.

With *L* and *P* given, formula (2) can be used to find the combined unit stress *S*.

If the section is circular, the diameter *d* can be substituted directly in formulas (3) and (4).

Practically all accident insurance in Germany is of the mutual kind. Accident-insurance institutions are employers' associations organized according to trades or crafts for the purpose of carrying mutually and collectively their workers' accident-compensation risk. Under the German law every employer must belong to the organization of his craft and to these employers' associations is given the necessary legal power to enforce accident-prevention and insurance rules, not only upon the employer but also upon the worker.

Air Brush Fixtures and Tools

Editorial Correspondence

The construction of a standard air brush, the pressure used, what it will spray and fixtures for holding and revolving the work. Machines and tools for producing some of the parts.

The DeVilbiss Manufacturing Company, Toledo, Ohio, makes air brushes, vaporizers, atomizers and numerous other things used for toilet and surgical purposes, but with the exception of the small atomizers, which may be used for spraying antiseptic solution on wounds, the only instrument of interest to the shop man is the air brush or vaporizer shown in Fig. 1, which may be used for spraying lacquers, varnishes, paints, bronzes or anything of that nature, faster, smoother and more economically than by any other method.

From the very nature of the material handled by these air brushes, they must be made so as to be easily taken apart for cleaning and the series of pictures shown in Fig. 1 illustrate this plainly. *A* shows the air brush with the spraying nozzle *B* removed, which is done by simply loosening the thumb screw *C*, swinging back the hinged C-clamp *D* and lifting out the part. An air brush with the nozzle in place is shown at *E*, and at *F* in both views is shown the air-pressure hose connection. At the back end of the nozzle will be noticed a small thumb-operated plunger, which is used to clear the nozzle without removing it from the instrument in case of ordinary clogging. The regulation of the normal position of the point of this plunger or needle, also determines the fineness of the spray thrown. At *G* the entire top is shown removed, the only thing necessary to do this being to press on thumb lever *H* and lift of the top. Pressure on the lever *I* opens the air valve and starts the spray. A careful examination of these cuts will give a good idea of the construction without further explanation.

*Associate editor.

Pressure Used for Air-brush Work

In using these air brushes an air pressure of from 25 to 30 pounds is used for lacquers and from 30 to 75 pounds for paints or enamels, and the size of the spray is regulated both by the needle previously referred to and the amount of air admitted, which is determined by the thumb pressure on the air-valve lever.

Tables for Revolving the Work

For spraying small parts of various shapes, whether of wood or metal, a hood large enough to allow easy handling of the work is usually provided, and Fig. 2 shows one of these hoods fitted up with a special motor-driven table for revolving the work, which in this particular case was small metal wagon boxes. The mechanism of this table drive is shown in detail in Fig. 3, which is a view looking up under the bottom of the hood stand. *A* is the motor which drives pulley *B* by means of a round leather belt. This pulley drives the gear *C* by means of a worm, and this gear drives the friction pulley *D* in contact with friction disk *E*, the position of the pulley on the disk, and consequently the speed, is regulated by lever *F*. The table may be stopped independent of the motor by means of lever *G*, which admits air to the little cylinder *H*, which forces up the small piston, raising the disk *E* off of the friction pulley *D* by means of the forked lever *I*. The table may also be raised or lowered at any time by means of lever *J*, which controls the air admitted to the cylinder *K*. The motor switch is located at *L*, within easy reach of the operator's left hand.

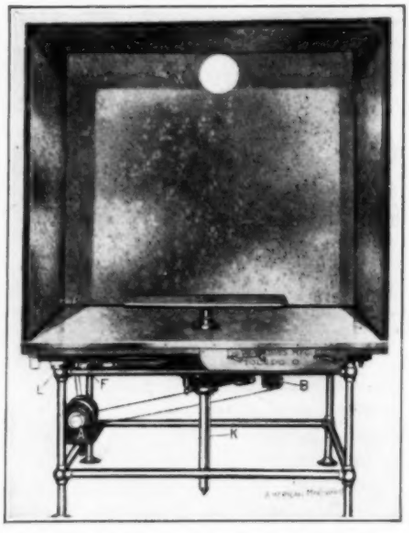


Fig. 2. A Spraying Hood and Revolving Table

Fig. 4 shows another type of table used to hold lamp, bed or other hollow parts while spraying. This table has jaws similar to chuck jaws for holding the work and a ball and pillow block base, so that it may be tilted to any desirable angle. This table may be set inside of any flat-bottomed hood and is turned by hand.

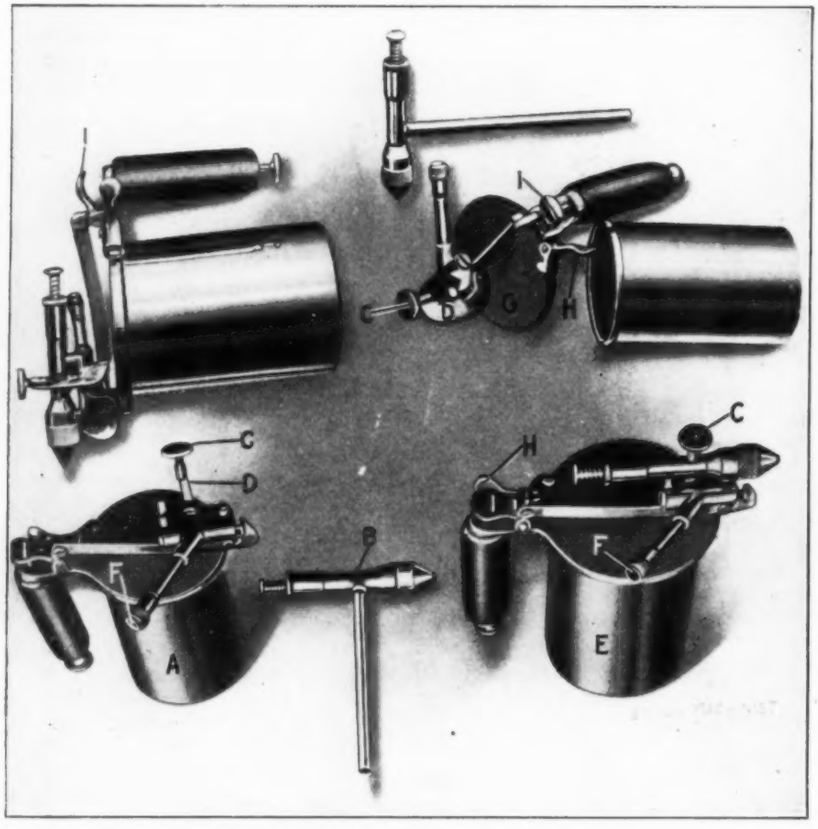


Fig. 1. The Construction of an Air Brush

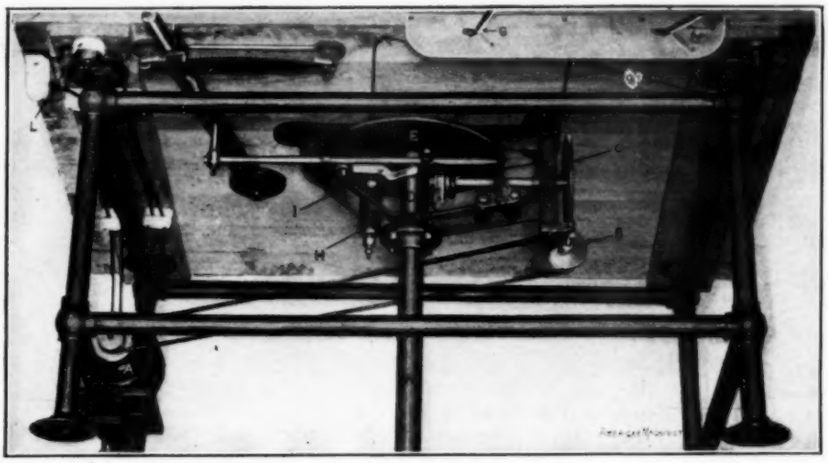


FIG. 3. DETAILS OF THE REVOLVING-TABLE MECHANISM

AN AUTOMATIC ANNEALING AND BENDING MACHINE

Some of the machines and tools used in making air-brush and atomizer parts are unusual, and an automatic annealing and bending machine used for annealing small tubes in three places and bending an L on one end, is shown in Figs. 5 and 6. The tubes are placed in the hopper *A* and drop one at a time into notches in the carrier *B* and are carried around about one-third of a turn, being heated as they travel, then are bent and dropped into a pan, the operations being continuous.

Fig. 6 shows the details a little better than Fig. 5, but the reference letters here given are the same for both cuts. Belt *C* runs an eccentric shaker arrangement *D*, which is used to shake the hopper so that the tubes will feed down onto the carrier and not stick in the hopper as they would be apt to do if this were not done. The carrier is driven by belt and pulley *E* and *F*, through gearing, and the blow torches *G*, *H* and *I* are so made that they follow each tube as it travels for the length of one space and then swung back to the next, this distance being sufficient to heat the tubes to a red. The torches *H* and *I* simply spot anneal the tubes for future operations, but torch *G* anneals the ends so that they may be bent L-shaped, as they are carried past the grooved roller *J*, the metal guide *K* shoving the tube in just before it strikes the roller. This shoving in of the tube is necessary to insure the right length of bend and also because the tube has to set out pretty well from the side of the carrier in the first place in order to be heated back far enough for the bend.

A SIMPLE AUTOMATIC

Probably the simplest automatic machine that could be constructed is shown in Fig. 7. This machine is used to slightly flatten short pieces of small brass tubing, and the working parts consist principally of the revolving disk *A*, having a hook or finger *B* set into the edge, which travels in a V-groove in the bottom of hopper *C* and picks up one tube at a

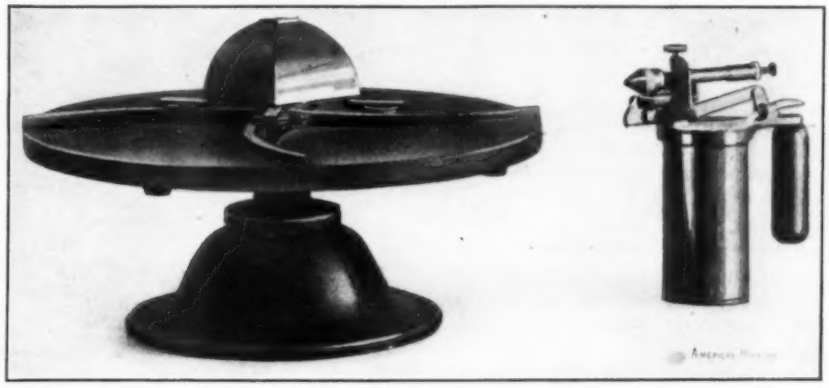


FIG. 4. REVOLVING TABLE FOR SMALL PARTS

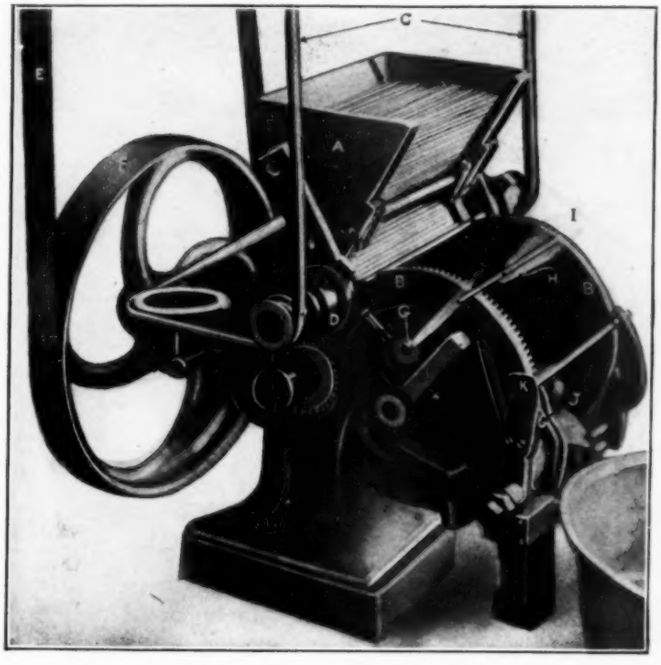


FIG. 5. AUTOMATIC ANNEALING AND BENDING MACHINE

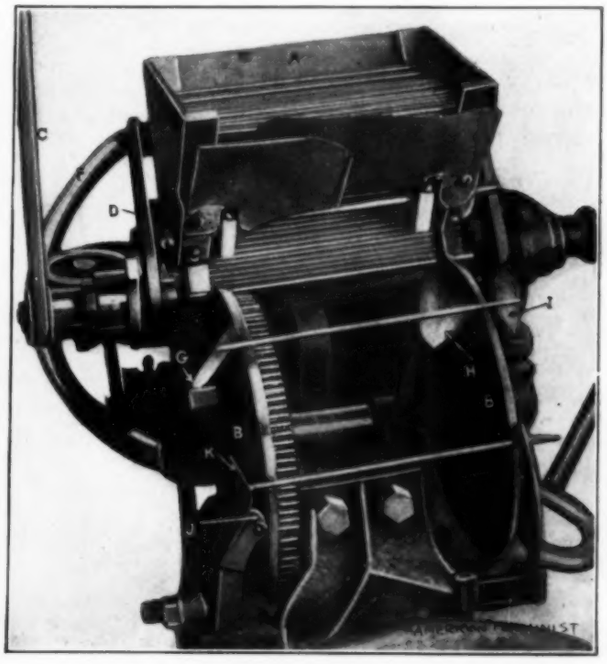


FIG. 6. VIEW OF MACHINE FROM THE FRONT

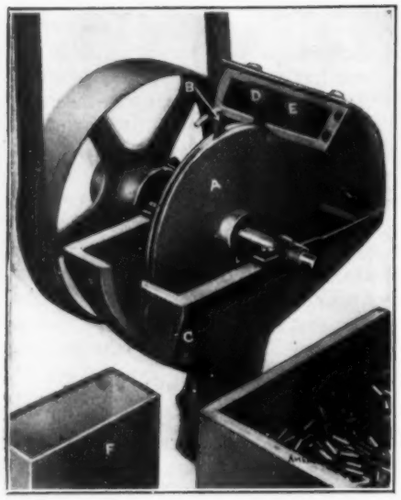


FIG. 7. TUBE-FLATTENING MACHINE

time, carries it between the flattening rolls *D* and *E* and, as it continues on around, drops the flattened tube into the box *F*. All that is necessary to operate this machine is to start it running and to throw in a few handfuls of tubes once in a while.

PUNCHING HOLES IN BRASS SHELLS

Three holes are punched in small brass shells used for atomizer tops, in the press shown in Fig. 8. The shells are slipped over the punch holder *A*, and as the hand lever *B* is swung around, the holder moves down, forcing the two punches *C* and *D* through the thin brass into the die *E;* then the lever swung in the opposite direction, moving the holder plug up, and, as there is no stripper, carrying the shell with it until the punch *F* is forced through into die *G;* next the holder is moved to a little below central position, which strips off the shell as the side strikes die *E*, and the natural spring of the shell as it strips from the punch ejects it, the inside diameter of the shell being somewhat larger than the distance

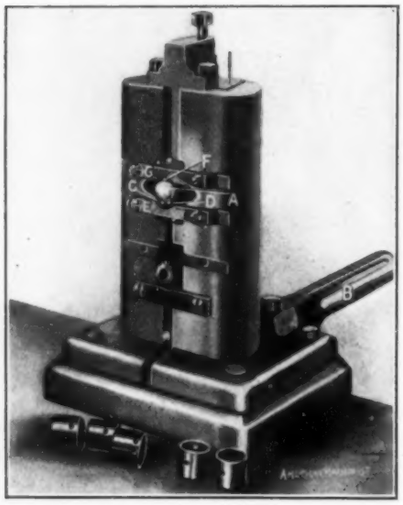


FIG. 8. SHELL-PERFORATING PRESS

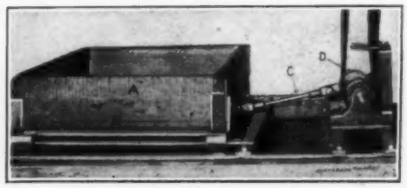


FIG. 9. CHIP-SCREENING MACHINE

between the ends of the upper and lower punches.

SHAKER FOR METAL CHIPS

A mechanical shaker for turnings is shown in Fig. 9, the frame being made so that a square sieve *A* may be set into the frame *B*, which is given a reciprocating motion by means of the connecting rod *C* and eccentric *D*.

A SPECIAL POLISHING HEAD

In the polishing room no overhead belts are in evidence, the special stand shown in Fig. 10 being used. This stand is so made that the head carrying the spindle may be lowered by turning the handwheel *A*, which operates the cam *B*, the spindle head being hinged at the back. A block of wood is set into the column of the stand just under the spindle pulley, so that as the head is lowered to loosen the drive belts, the pulley rests on the wood block, which acts as a brake.

DRILLING JIGS

A number of drilling jigs are shown in Fig. 11, most of which are shown just to illustrate the latching schemes

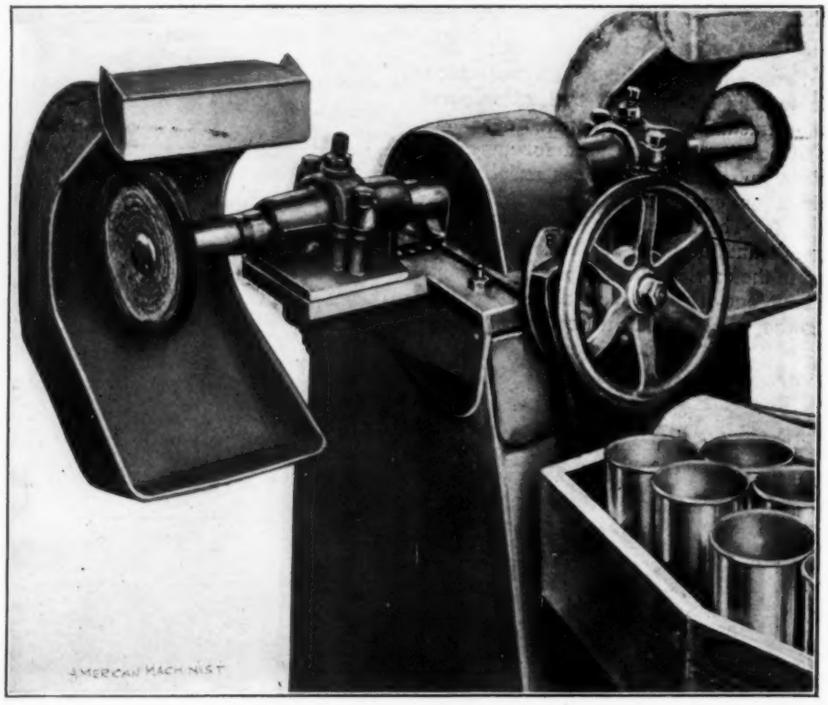


FIG. 10. CAM-OPERATED POLISHING HEAD

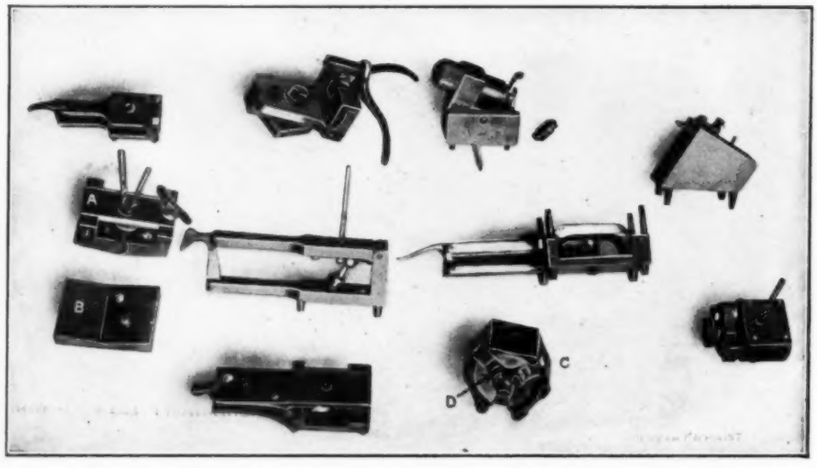


FIG. 11. DRILLING JIGS FOR ATOMIZERS AND AIR-BRUSH PARTS

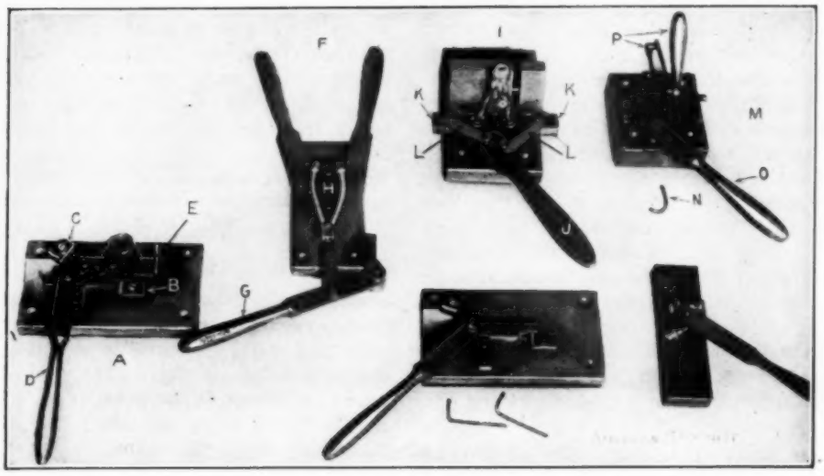


FIG. 12. BENDING FIXTURES FOR WIRES AND TUBES

used, but jig *A* is used to drill two holes at an angle to each other, which is done by making the base of the jig a broad V, and using the base *B* to give the two positions under the driller spindle. Jig *C* is used to drill three holes in a ball-shaped piece of brass that has a stem on it; the jig is made out of a small three-jawed universal lathe chuck with the small step of each jaw bushed for the drill, and the jaw *D* cut back to make room for the stem of the piece, the hole in the stem being drilled lengthwise and the other two holes meeting it at an angle of 120 degrees. The chuck body has been machined to a hexagon shape, so that it is easily placed in the correct positions on the driller table.

BENDING FIXTURES

Fig. 12 shows a few bending fixtures. Fixture *A* is used to bend an L-shaped end on small pieces of wire, *B* being the stop gage for the wire and *C* for the bending lever *D*, while *E* is the ejector operated by hand. Fixture *F* is used to bend in the ends of vaporized tubes, lever *G* with its plunger being used to hold the head against the form *H*, while the other two levers are used to bend in the ends of the fork. Fixture *I* is used for bending in the nozzles of a different style of head, the action of lever *J* being to move the sliding blocks *K*, to which it is fastened by the two connecting pieces *L*. Fixture *M* bends small tubes into the shape shown at *N*, *O* being the bending lever and *P* the ejector. Fixtures *R* and *S* are simple bending devices, the first for wire and the second for atomizer tops.

Fig. 13 shows a very convenient form of fixed soldering torch, using gas and compressed air, which is used for soldering all kinds of small parts.

FIG. 13. A BENCH SOLDERING TORCH

Curling Die for a Sliding Cover

BY ARON LAWRENCE

During a recent conversation with a sheet-metal expert, I was shown some dies for peculiar-shaped pieces, and among them was a simple curling die for the rectangular part shown in Fig. 1. This is a brass sliding cover, and is blanked and pierced as shown at *A*, in a combination die of the usual construction. It is then formed to the shape shown at *B* and edged as at *C*, after which it is ready for curling, and for the accomplishment of this, the die shown in Fig. 2 is used, the base of the die *A* being a cast-iron shoe whose upper surface is machined to conform with the desired shape of the cover after forming.

Hardened-steel screw pins *B*, *C* and *D* are provided in the base for the purpose of properly locating the work in the die. The pins marked *D* being used for two pieces, which differ only in the location of the pierced holes, in conjunction with pins *B* in one case and *C* in another. The pins not being used are screwed down into the base *A*, so as not to interfere with the work, and holes are drilled in the forming block *D*, into which the pins in use pocket when the die closes.

The upper portion of the die comprises the curling member *F* of cast iron, and the forming slide *G*, also of cast iron, and carrying on its under surface the forming block *E*, of hardened steel, the edges of *F* being beveled so as to readily catch the ends to be curled and the stroke of *G* being limited by the shouldered stud *H*.

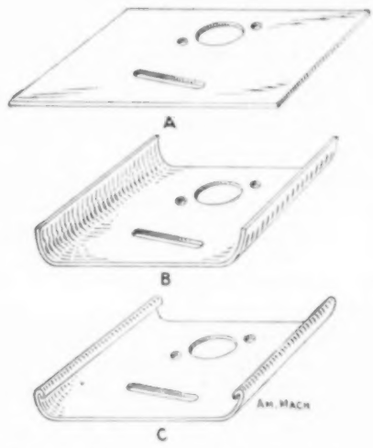


FIG. 1. STEPS IN THE FORMING OF A SLIDING COVER

Heavy helical springs *I*, in suitable holes in *F* and *G*, serve to keep the forming slide extended until after the piece is pressed into the die shoe *A*, after which the curling member *F* descends and curls in the edges of the panel.

The work shown me was nicely formed and showed no line at the die junction,

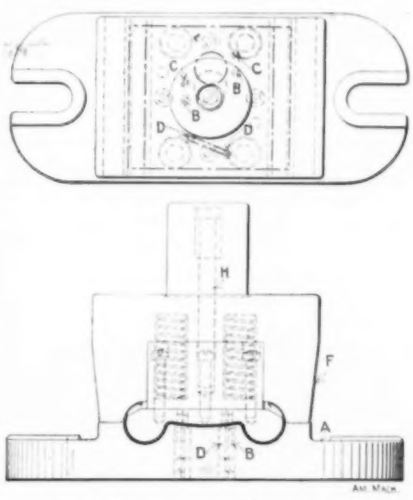


FIG. 2. DETAILS OF CURLING DIE

but it seems that some unnecessary handling is done to accomplish the forming of the piece, as the forming of the ends as shown at *B*, Fig. 1, could readily be done in the edging die, thus eliminating one die and the consequent handling.

Graphical Means of Scheduling Purchased Materials

The several articles dealing with shop-routing systems that have been published in our columns show the interest that is being taken in devising means for controlling manufactured products and delivering them to the assembling room as soon as they are needed. The importance of controlling the receipts of parts purchased outside is of equal importance in some lines of machinery building; for illustration, in the automobile industry.

At the works of the Columbia Motor Car Company, Hartford, Conn., means have been devised whereby the one in charge can see at a glance the number of parts of each kind that are on hand and just what orders must be hurried. Fig. 1 shows the large board used for this purpose, located in one of the production offices. This board is divided into spaces by horizontal and vertical lines. At intervals there are pasted on vertical strips of paper, numbered consecutively from one at the top to several hundred at the bottom. These numbers indicate the production of cars. At the top and bottom are racks carrying slips of paper upon which are written the names of the various kinds of products purchased from outside; for instance, ball bearings. This board takes care of a season's output of cars.

As fast as material is received from outside the receiving slips are sent to this office and pins with large glass heads are put into the board in a position indicating the number of cars for which that particular kind of material has been received. Thus if 800 pieces of a certain kind are received, and four are required on each car, the pin is moved along a distance representing 200 cars. Thus each pin on the board shows the number of cars for which the particular kind of material, represented by the paper slip at the bottom with which it is in line, has been received.

In order to show the number of pieces of each kind that are ahead, that is, awaiting the assembling room, a string is stretched across the board horizontally, indicating the number of cars that have left the testing floor for the store room. Thus the distance between this horizontal cord and the glass-headed pins shows the number of each kind of parts that are in stock and indicates to the one in charge how long that stock will last. The part of the board which we have been considering is the left-hand end and does not include the three vertical spaces at the extreme right. These spaces are for cars that have actually been shipped. The system used is identical with the one just described, except that the materials here referred to are the wrenches, lamps and various other accessories that are added to the car after it has been completely assembled and tested.

Another feature which does not show well in the photograph but is of importance consists in slipping a short length of rubber tubing around some of the glass heads. This indicates a stop order issued by the production office. In cases where the pins do not have these pieces of rubber tubing the orders have not been held back and the responsibility for shortage, if any occurs, lies upon the shipper.

This method has worked so successfully during the past season that it is about to be extended in connection with next year's output. Fig. 2 shows four other boards that have recently been put in place and are to be used in a manner similar to the one just described, but for castings. As laid out, each important foundry from which castings are ordered has a board, and by its use it will be possible to get castings as they are required. Thus if a foundry tends to mold a large order of one kind of casting and holds back on some other kind, a glance at the board will show this fact and steps can be taken to regulate shipments from the foundry to make them correspond with the needs of manufacturing departments.

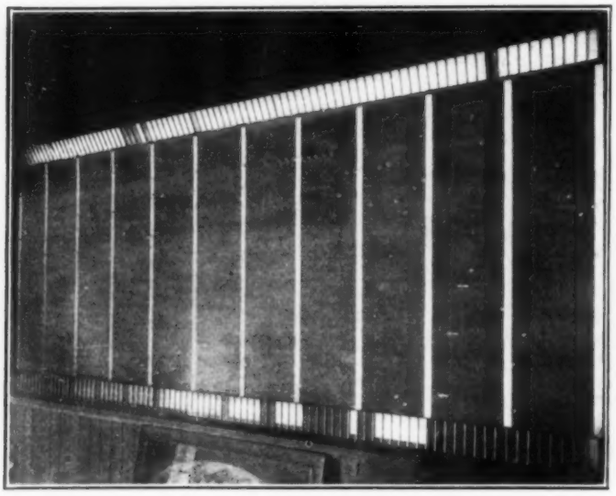


FIG. 1. BOARD SHOWING GRAPHICALLY THE RECEIPTS OF PURCHASED MATERIAL

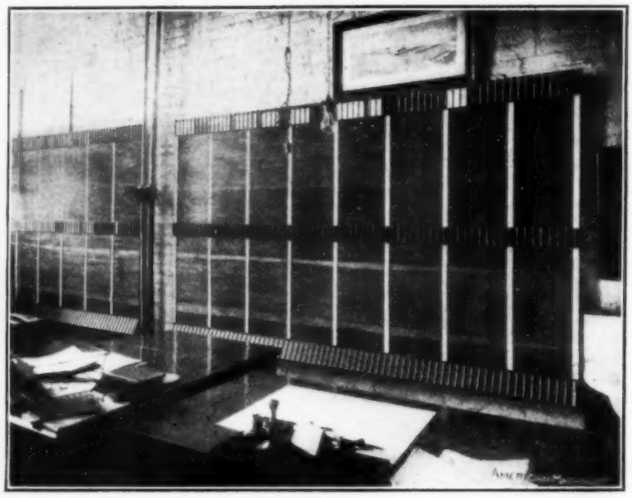


FIG. 2. BOARD SHOWING RECEIPT OF CASTINGS

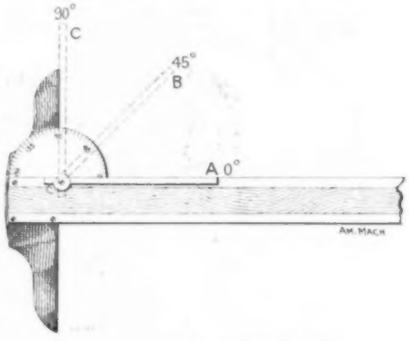
An Angle Measuring Device

BY B. F. DASHIELL

This angle-measuring device can be easily attached to the ordinary T-square.

A small metal protractor is used to get the angles. It is fastened to the T-square, as shown in the illustration, with the 90-degree mark coinciding with the head, and the 0-degree mark with the straight edge.

A small scale with one straight edge is bolted or screwed on, so that when it is in a straight line or parallel to the T-square, it measures 0 degrees on the protractor, and is in the position *A*. When it is in the position *C*, it measures off 90, and when in position *B*, 45 degrees.



AN ANGLE-MEASURING DEVICE

Any angle can be obtained and drawn, simply by turning up the scale, until its top straight-edge coincides with the degree mark wanted on the protractor. The line is drawn along the scale and gives the angle to the T-square.

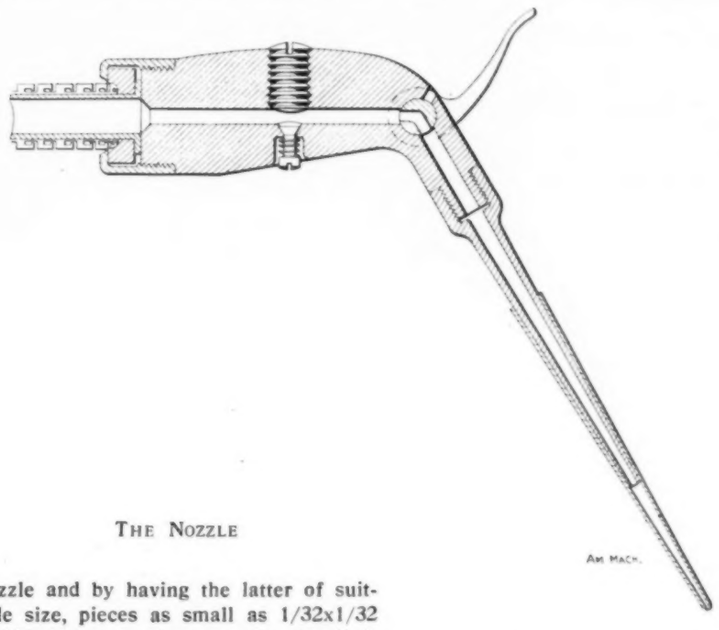
Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.
A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Handling Small Parts by Vacuum

In manufacturing jewelry and miniature marquetry work known as "articles de Paris" there is sometimes a quantity of small light parts of ivory, gold, silver or wood to be handled that are so thin that pinchers may spoil them. A very handy way to pick them one by one without deformation is to use vacuum. For infrequent service a rubber bulb as used by photographers, provided with a tubular nozzle, is sufficient. But for regular work, I found the following arrangement satisfactory.

A small electrically driven blower is used to create 6 to 10 inches of water vacuum in suitable piping. An armored rubber tube connects to the nozzles provided with a three-way cock. By pushing the cock handle, air is pumped through the



THE NOZZLE

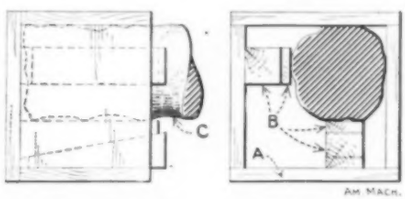
nozzle and by having the latter of suitable size, pieces as small as 1/32x1/32 x0.001 inch of silver can be handled. Pulling the handle breaks the vacuum in the nozzle and the piece is free.

For such small pieces as mentioned above, 6-inch vacuum is too much to allow them to be picked up one by one from the pile in the right position; hence, we added the small valve in the handle to regulate aspiration while separating the points. The nozzle is made large enough to accommodate the largest pieces to be handled, and several adapters are provided, these being simply tubes fitting the nozzle and having various sizes of holes.

Lynn, Mass. P. P. FENAUX.

Fixture for Drilling Iron Pigs

In drilling iron pigs for samples we had some difficulty holding them, owing to their uneven shape. Sometimes the pigs would spin around with the drill and mar the driller table. To overcome this a fixture was made, as shown in the accompanying figure. The wooden box *A* is made of 2-inch pine board, 8½x8½ inch by 7 inches deep. Four wooden wedges *B* are made large enough to hold the pig firmly when tapped with a hammer.



FIXTURE FOR DRILLING IRON PIGS

Buffalo, N. Y. C. HATTENBERG.

Grinding Thread Tools and Sawing Thin Stock

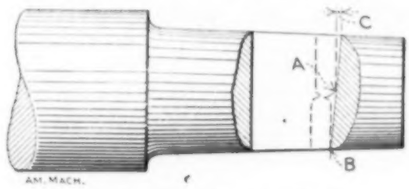
When grinding a thread tool to gage, it is a good plan to use a piece of plate glass about 1½ inches square and hold the gage flat on it between the eye and the light, then the point of the tool can be fitted to the gage without trouble.

In sawing thin sheet stock, I clamp it in the vise between two pieces of iron, close to the scribed line, setting the iron pieces in the vise at a 45-degree angle; then with the hacksaw at right angles to the frame I saw the stock easily and quickly without stripping the teeth.

Detroit, Mich. J. C. PUGH.

Key Slots in Piston Rods

The line cut shows how I lay out the slots for drilling. The distance *C* is half the taper of the key and the drill is run



KEY SLOTS IN PISTON RODS

from either side to the center of the rod at the taper end of the slot. This method gives two guiding points *A* and *B* for the filer to work to when filing the line *B C*.

Geneva, N. Y. ANDREW HARVIE.

Auxiliary Jaws for the Vernier Caliper

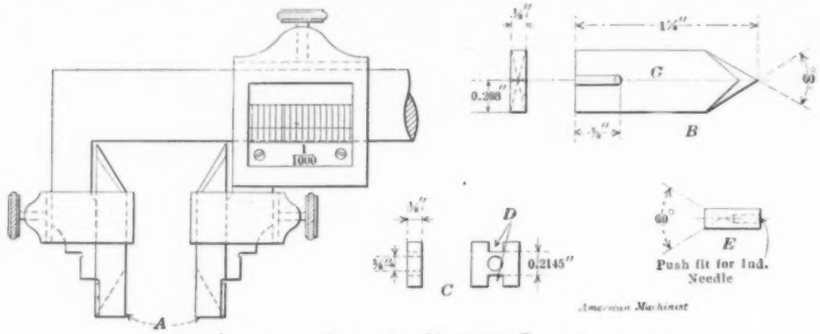
The attachments described below will be found very useful to anyone having a six-inch vernier caliper. By their use we have, besides a vernier for outside and inside measure, a vernier divider and a direct-reading tool for inside measurements.

The accompanying cuts show the method of attaching the auxiliary jaws and besides giving a direct reading, the jaws have the additional advantage of adjustment for wear. The clamps shown, are a pair of Brown & Sharpe light-gage auxiliary jaw clamps but the rest of the outfit must be made. The jaws *A* are ground on one end to a 60-degree cone

point and on the other to ¾ inch diameter, the dotted lines on the jaws showing position of divider points when in use.

The measuring surface and the side which goes next to vernier jaw, must be a perfect straight edge and the tool fitted with these jaws will scribe radii from ¾ inch up, and measure holes ¾ inch in diameter or over.

To finish the jaws after they have been roughed out secure a small angle iron to the faceplate of a universal grinder and square up the edge of the pieces with the faceplate, being sure that the faceplate runs perfectly true and using the piece *C* which is made in the following manner: Drill and ream the ⅛ inch hole in piece *C*, place on an arbor having a thread and nut and put between index centers of miller and mill slots *D*, ⅛ inch wide and to the depth indicated in the cut, setting milling cutter perfectly central.



AUXILIARY JAWS FOR VERNIER CALIPER

For truing the jaws, place them in slots *D* and true up the ⅛-inch hole with an indicator, thus insuring the jaws running true, then grind to ¾ inch diameter; next turn the jaws around and place them together at *B* and make a female center *E* to go on the needle of a wiggle indicator, then true the jaws and grind to a 60-degree point. The pieces can now be lapped on edge *G* till a perfect straight edge is obtained with the radius on the jaws.

The divider points will be found very handy for laying out jigs, fixtures and dies and do away with the setting of dividers by means of the points on the verniers, which is unhandy to say the least.

W. C. BILLINGS.

New Britain, Conn.

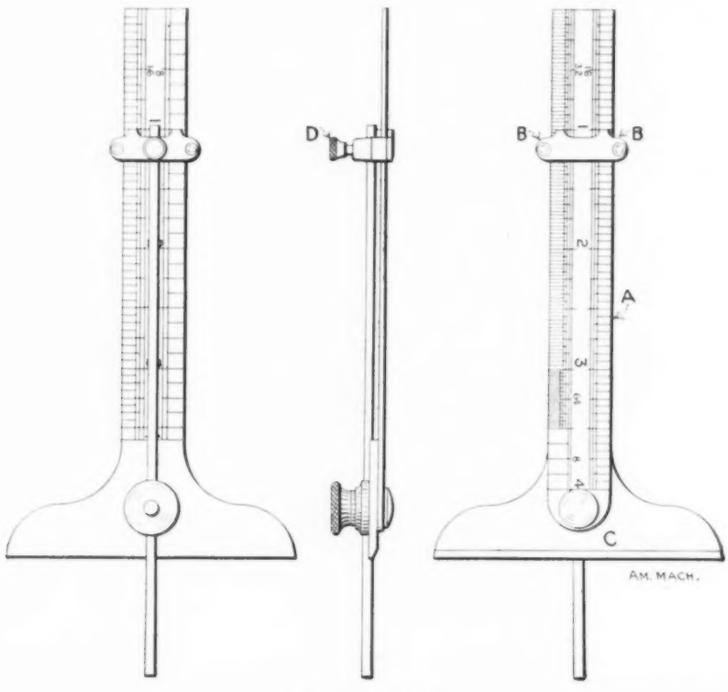
A Depth Gage

In my work I frequently have to bore holes of different depths and sizes, and a few years ago I made a quick-setting depth gage to save time in measuring them.

The gage is made up as shown in the sketch on which *A* represents an ordinary 4-inch rule. When points *B* are at the end of the rule, the depth bar is flush with the stock *C*; as shown in the sketch the gage is set at one inch depth. When the measuring bar wears on the end it can be adjusted by means of the pin *D*. The whole thing is very simple and has the advantage of being adjustable in inches or millimeters or anything that is marked on the rule; and is more accurately and quickly set than the ordinary type of gage.

JOSEPH BUTLER.

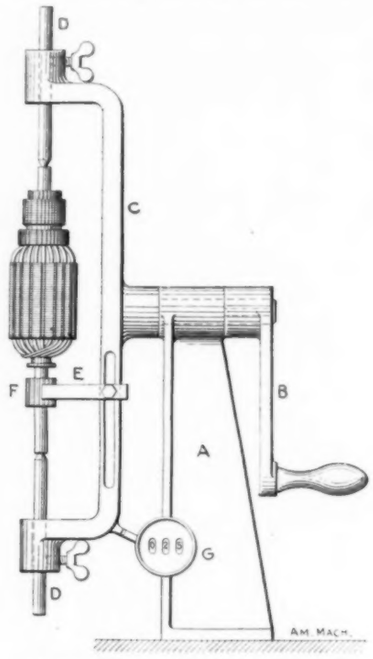
Birmingham, Eng.



A DEPTH GAGE

A Hand Winder for Small Armatures

In our factory we use a large number of small electric drills and, after trying getting them repaired by the makers and losing the use of the machine for a long time, we began to repair them ourselves. We made the following fixture to hold the armatures when rewinding:



HAND WINDER FOR ARMATURES

It consists of a bracket *A* screwed to the bench, and revolving frame *C* turned by crank *B*, and carrying two adjustable centers *D*.

A spring catch *E* engages the gear *F* on the armature and holds it in any desired position.

As there are over 50 turns on each winding of many of these armatures, we added counter *G* to the apparatus, thus relieving the operators of the mental strain of keeping the count through all the interruptions.

Of course, the actual guiding of the wire has to be done by hand, but the fixture holds the armature in a favorable position while the work is being done.

W. A. VALENTINE.

Philadelphia, Penn.

Tapping Thin Tubing

We had a lot of thin tubes to cut off and tap. The tubing was 1¼ inches outside diameter, with a wall 0.025 inch thick; this is a rather flimsy piece of material to handle. Of course, we did it in the turret lathe, gripping the tubing in the 1¼-inch collet. After tapping one of the pieces and trying to enter the plug gage, we found the tapped hole quite small. After investigating the matter we found that the tap, being four-fluted, had sprung the thin tube in the manner shown exaggerated in Fig. 1.

We tried gripping the tube flush with the end off the collet when tapping, but it forced the metal into the slots in the collet, leaving ridges on the outside of the tube. We then made a heavy collar of cold-rolled steel that would just slip over the tube, and with this over the end of the tube when tapping we had no trouble to keep the hole to size, nor did we have any trouble in getting the collar off after tapping.

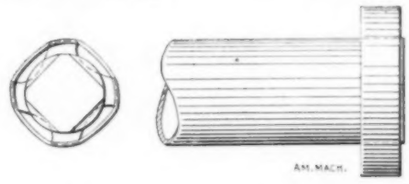


FIG. 1. TUBE SPRUNG BY TAP FIG. 2. TUBE AND STEEL COLLAR

It is evident that this is a case where a large number of flutes in the tap would work to advantage. The tap was 36 threads per inch, V-form, and we allowed 0.036 inch for the double depth of thread, which gave practically a full thread in the tube.

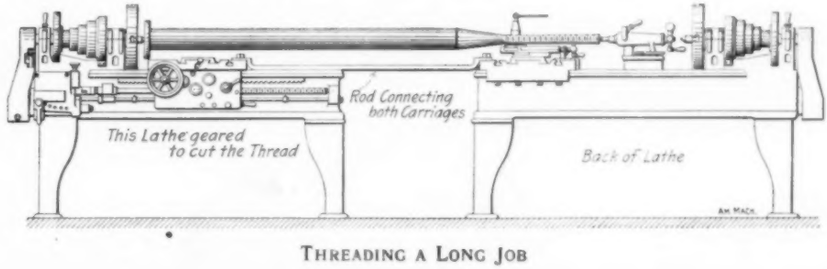
E. A. ERMOLD.

Philadelphia, Penn.

Threading a Long Piece

We had a very difficult job to do and had no long lathe on which to do it. We took the two small lathes shown in the sketch and did the job successfully. We turned one lathe around and lined it up and put a rod on the carriage. We cut the threads and used the compound rest to turn the taper. We had quite a few of them and when cutting the threads a boy was employed to put the lock nut in. We put a steady rest on each lathe and crossed the belt and it worked very well. Now the boss never turns any long jobs away.

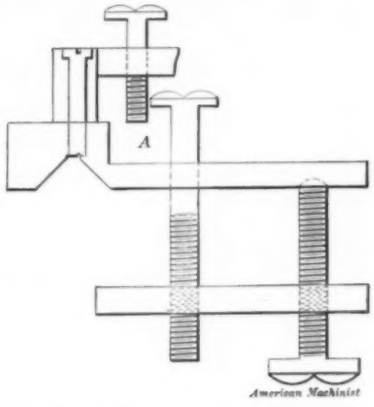
Elizabeth, N. J. M. MOGENSEN.



THREADING A LONG JOB

Holder for Indicator Stop on Lathe

The accompanying cut shows a device which is clamped onto the V of a lathe for holding an indicator when it is used as a carriage stop. The cut shows plainly how the device is made and used, the indicator being clamped at *A*. I find this very convenient for lots of work and much better than a depth gage.



HOLDER FOR INDICATOR STOP ON LATHE

W. J. WILBER.

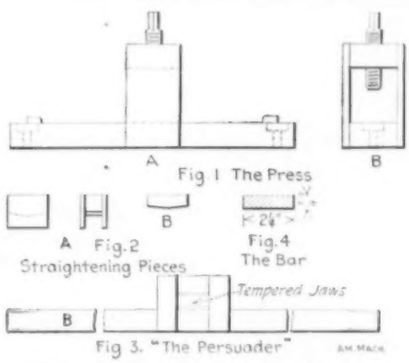
New Britain, Conn.

Straightening Drawn Steel Bars

We used a quantity of cold-drawn steel ¾ inch thick and 1½ and 2½ inches wide which had been annealed and straightened at the mills. As that term "straight," however, is only relative as applied to bar stock, a large proportion of the bars had to be straightened again and brought within our required limits of "two newspapers." As machined, the stock was cut into lengths of 2 to 5 feet. No attempt was made to straighten until after cutting off. All bends and "kinks" had to be removed, and, at the same time, any twist that might be in the bar had to be taken out.

Fig. 1, *A* and *B*, shows the press we made to do the work. The horizontal members are sections of 2x3-inch bar iron to which are fastened side plates, ¾x4 inches, by means of ¾-inch steel pins riveted over. The base is counterbored for bolts to set flush when the press is on a planer or sub-face-plate. Instead of using a permanent handle, the screw is squared to fit a large tap wrench. Blocks to rest the work upon may be seen near the ends of the base. The rounded edge of the top is proof against denting and bruising the bars. For service on the upper side of the bars, two pieces were used; namely, *A*, Fig. 2, when straightening edgeways, with chips to keep it in place, and *B*, Fig. 2, for work on the flat side, this piece being an easy fit one way between the uprights of the press. It will be noted that both of these pieces have faces beveled off from the middle.

Harder than the task of straightening was the one of removing the twist or "wind" in the stock. With the assistance of a piece of pipe we sprung one monkey wrench out of parallel and then got down to business by constructing a "persuader" in the form of Fig. 3, made of the 2½-inch size of the drawn steel itself, well riveted, and fitted with jaws of tool steel. This formed a valuable tool. With a man at each end of the 6-foot handle *B* it was possible to twist a bar with ease, yea, to overdo it and break one in two. Even with such heroic methods, the jaws of the wrench did not mar the bars for the reason that they were purposely made wide. During the twisting operation, the bars were securely clamped at the point where the twist began.



STRAIGHTENING DRAWN-STEEL BARS

It was our experience that there was no royal road to the desired results and that the slow way was shortest in the end. But that the task was an arduous one, goes without saying, the expression "getting it worse before getting it better" applying with full force.

Especially vexatious was the correction of a bend and a twist in the same bar; the one would reappear when the other was taken out. As the bars were polished later, it was desired to main-

tain a nice, unbruised surface. Possibly some other readers of the AMERICAN MACHINIST may have had experience along similar lines, but with other means. The tools described were simple, inexpensive and efficient.

D. A. HAMPSON.

Middletown, Conn.

A Shell Perforating Fixture

The sheet-brass shell shown in section at *A* in the accompanying cut, is perforated with two one-inch round and two one-inch hexagon holes, and the construction of the fixture used for this purpose is interesting.

The die used in the fixture is made in four sections in order to fit snugly inside of the globular-shaped shell, these four die sections fitting around a square post set upright in the center of the fixture, the post used being shown at *B* and the die sections at *C*. In this latter figure the sections are shown screwed, for the purpose of turning, to the mandrel *D* with fillister-head screws *E*.

The shape of the tool-steel punches used, is shown at *F* and the punch holders, to which the punches are screwed, are shown at *G*.

The cut of the fixture shows it all ready to perforate a shell, the punches and punch holders *H* which slide in slots in the bed of the fixture being connected by links *I*, to the ring *J* having a gear segment cut in it at *K* which meshes with the segment *L* operated by the lever *M*, the movement of which gives the motion necessary to work the punches.

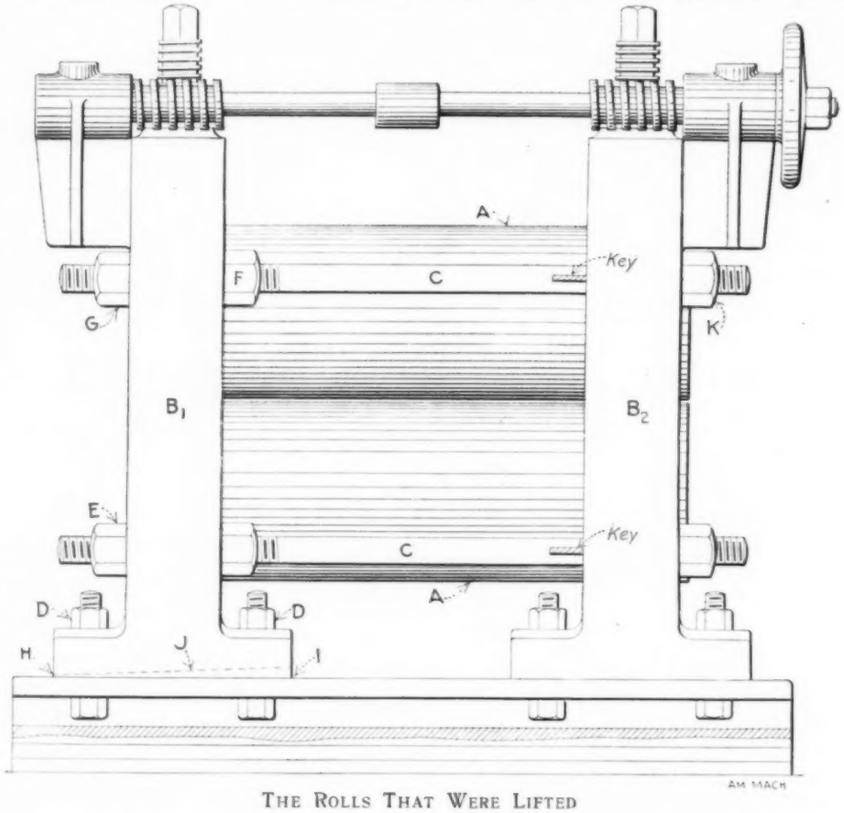
The principle of this fixture may be used for various shaped articles and any number of holes, and for heavy work a worm and shaft with a good-sized handwheel may be substituted for the gear segments shown.

Kenosha, Wis. F. D. O'NEILL.

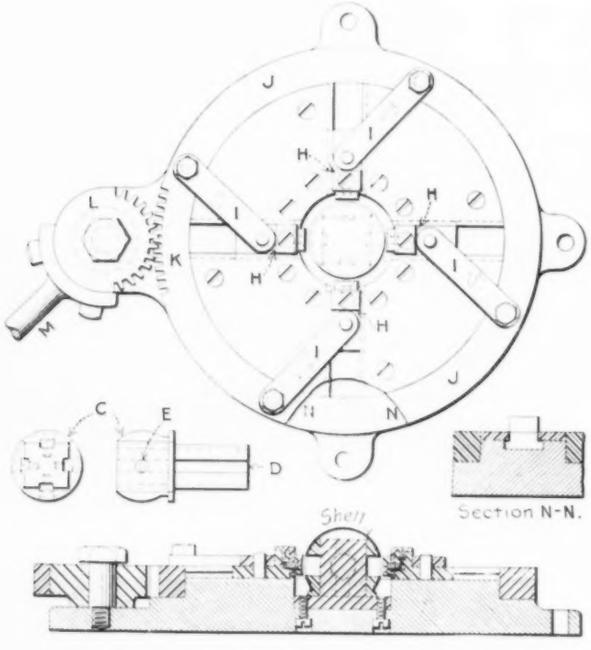
Moving a Heavy Machine

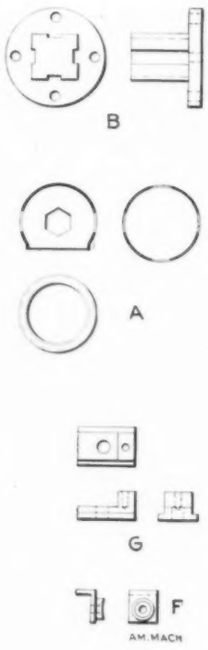
The work of raising a pair of rolls in one of the steel mills in Pittsburg was very interesting to me. The combined weight of the rolls and housing was 26 tons. The work was done by a man in charge and two helpers. The time required was two hours. The housings, rolls and tie rods are shown in the accompanying figure.

Starting with the bolts at the bottom, the nuts *D* were released about ½ inch, nut *E* about ¼ inch and nut *G* about ½ inch. There are four rods *C C*, two at



THE ROLLS THAT WERE LIFTED





DETAILS OF A SHELL-PERFORATING FIXTURE

the back and two at the front. By turning the nut *F* forward the housing *B* is forced out, the bottom resting on the corner *H* as shown by the dotted line *J*, thus making an opening about $\frac{1}{16}$ inch at *I*. Steel wedges are driven under the housing at *I;* these support the housing while the nut *F* is being released and nut *G* turned forward, thus rocking the housing on the fulcrums *H* and *I*. Each time, the housing is raised about $\frac{1}{16}$ inch until the required $\frac{3}{8}$ inch is reached. A $\frac{3}{8}$-inch steel plate is slipped under the base of the housing. The housing is then securely bolted to the foundation plate.

Housing *B* 2 was raised in the same way as *B*1 excepting that, instead of a nut on the rod *C* at the inside of the housing it has a stop key through the rod, making it necessary to use the nut *F* to force the housing out. Like *B*1, it the same as at *B*1.

The raising, wedging, and slipping the $\frac{3}{8}$-inch plate under the base was done was drawn back by nut *K*.

Pittsburg, Penn. JAMES MOORE.

Grinding Tanks on a Besly Grinder

Fig. 1 shows a Besly disk grinder grinding off the tops and feet of rectangular cast-iron tanks 5 inches wide, 5 inches deep and varying in length from 9 to 20 inches. On this work it is not necessary to grind to size or exactly parallel. The surfaces must be straight and flat and the manufacturing cost low.

The workholder designed for this job is shown in Fig. 2. An ordinary angle plate is bolted to the geared lever feed table of the Besly grinder carrying grinding disks 30 inches diameter. The work is forced against the grinding disk by a single ball point, projecting from the face of the angle plate and bearing in the center of the work, so that the work is free to "float" against the grinding disk and clean up with the removal of the minimum amount of stock.

The work is supported, and approximately centered on the ball point, by a simple frame, bent up from 1-inch square rough bar steel mounted on the face of the angle plate. This frame is drilled to carry adjustable stops for approximately centering the work on the ball point. By raising or lowering the frame on angle plate and changing the position of the stops, the one frame is used for grinding many different sizes of tank castings; varying in width, depth and length. The position of the ball point on the face of the angle plate is not changed.

These long castings are ground in a vertical position. This is desirable on such long work as it keeps the circle in better shape, the work is handled more quickly, and it grinds nearer flat and straight than if supported in a horizontal position.

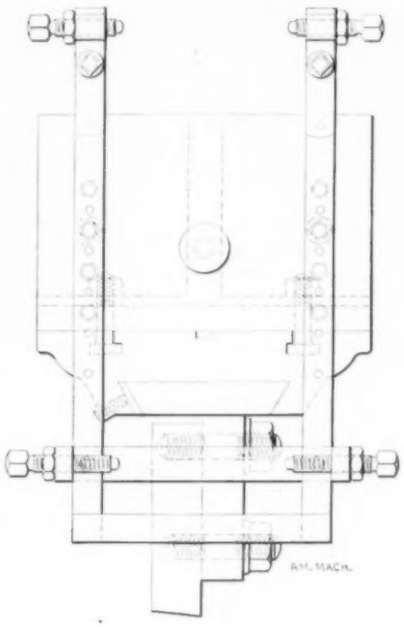


FIG. 2. THE JIG

The tops of castings 20 inches long by 5 inches wide are finished from the rough, by unskilled labor at the rate of 50 per hour, or eight times faster than the previous milling time. The circle used on this work is grain No. 16 Alundum.

The same fixture is used in grinding off the feet on these castings; the ball point in that case being on the end of a stud projecting far enough from the face of the angle plate to reach the inside of the bottom of the tanks and allow the work to float against the grinding disk.

Beloit, Wis. E. A. S.

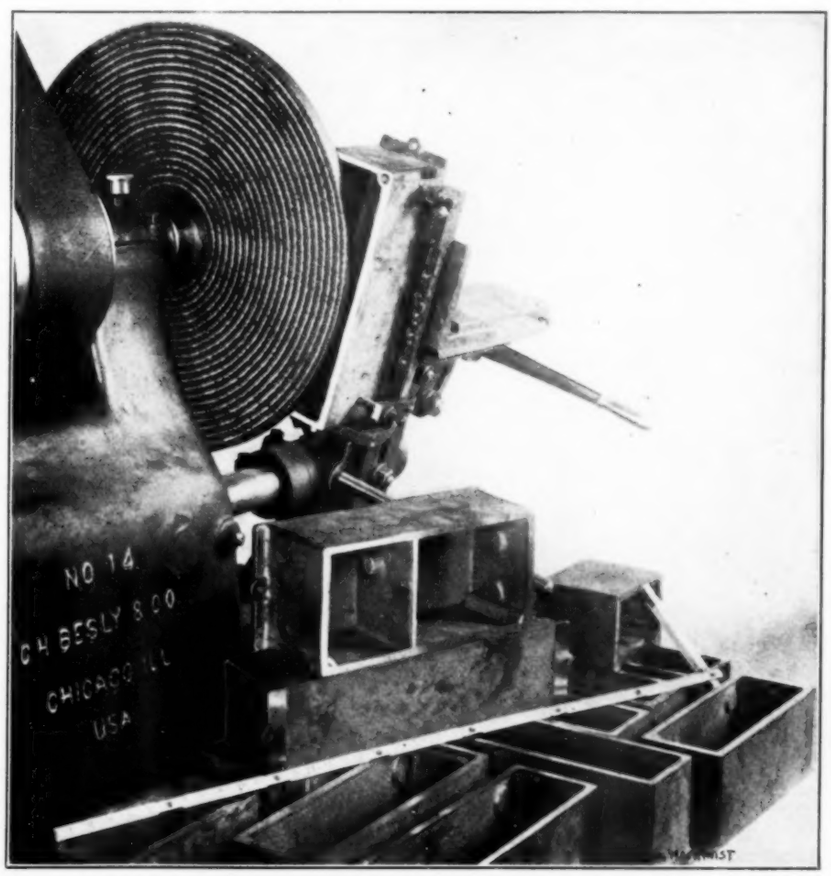
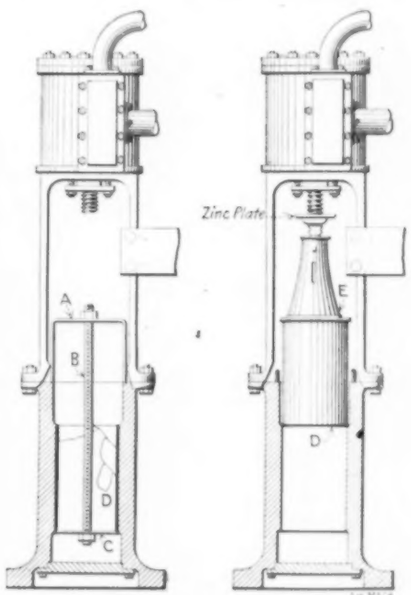


FIG. 1. GRINDING TANKS ON A BESLY GRINDER

Relining a Pump at Sea

We had a Worthington duplex pump to lift the water from the hotwell to a Worthington heater at the top of the engine room.

It had been working in a very erratic manner for a day or two, but, as shutting down to overhaul meant shutting down the heater and reducing our feed temperature from 230 to 125 Fahrenheit, it was allowed to run as it was in the hope of making port without any delay, however slight.



FIGS. 1 AND 2. RELINING A PUMP AT SEA

Our hope was short-lived, as one watch it stopped under full steam pressure and refused to move. We thought the steam valves had gone wrong or come off the stems, but examination proved them to be properly set and quite secure, so we had to seek elsewhere for the trouble.

The manner in which the pump had been working led us to suspect the trouble was in the water end.

A lever was placed under the piston-rod crosshead to try and move the piston

and bucket. One leg moved, while the other remained fast, so we dismounted the valve gear and crosshead, which was of the muff coupling type, in halves, held together by two bolts passing through the body.

We lifted the cover on the water end and found the liner was loose and had traveled with the bucket so as to completely shut off the water port, thereby imprisoning the water and stopping the pump.

A rope block was rigged up to the bucket rod and the bucket drawn out to enable us to get at the liner, which we found torn on one side, through a bucket (ring) breaking and jamming between the bucket and the liner.

As there was a spare liner on board, it was decided to take out the loose one and fit the spare one in its place.

To draw the loose liner out, a bridge piece was forged like *A*, Fig. 1, and a hole bored through the center to allow a 1¼-inch threaded rod *B* to pass through freely; then a plate *C* ¾ inch thick by 4 inches wide and ½ inch larger than the inside diameter of the liner *D* was cut and a hole bored through it to take the screw. When in position the apparatus appeared like Fig. 1.

As the nut on top was screwed up the liner followed, packing pieces being put under the top bar as the screw shortened, until the liner was clear of the chamber.

The chamber was then smoothed up with a half-round file and carefully calipered to ascertain if it was parallel in bore. It was found to be a shade smaller at the bottom, so was left that way.

The new liner was measured and found to be $\frac{1}{32}$ inch too big, rather too much for a press fit, as it was 10¼ inches diameter and ⅜ inch thick, it was filed off. While this was being done, a blow lamp was placed in the chamber to expand it a bit and make a tight fit when the liner was in place and cooled off.

The liner *D*, Fig. 2, was then placed in position in the chamber, which was counter bored for six inches down, and an old flange placed on top. A screw jack *E* was put on top of the plate with a zinc plate between the piston rod and the jack, so as to save the thread on the rod from being injured.

The jack was screwed up slowly and the liner forced into the chamber, until it was down to its proper position, 6 inches from the top and the bottom. The jack and plates were removed and the bucket tried in. It was a little tight and had to be eased off with a file until it was a good working fit, then it was put in place, the crosshead and valve gear connected up and the pump started up again. There has been no further trouble and the liner seems quite secure after three months' service night and day.

Halifax, N. S. F. MACY.

Drafting Kinks

The first two sketches, Figs. 1 and 2, show a method of holding more ink on the pen nib when writing or printing, and it saves quite a lot of dipping the pen into the ink. A piece of sheet metal of paper thickness, is cut to the shape shown by Fig. 1, and is attached to the nib by bending

FIG. 1. THE METAL

FIG. 2. THE METAL INSERTED

the sides around the nib as shown by Fig. 2.

Figs. 3 and 4 show methods of drawing the curved arms of pulleys. I have found quite a number of draftsmen who draw the curved arms by guessing the centers, having either forgotten that there is a method of getting the centers quite easily, or else never having learned any method at all. The sketches, I think, explain themselves, and are so simple that they do not require much committing to memory. The thickness of the arms, near the boss and near the rim, is, of course, decided by the draftsman.

Toronto, Ont. C. ARMSON.

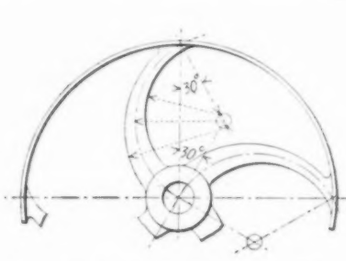


FIG. 3. DRAWING PULLEY ARMS

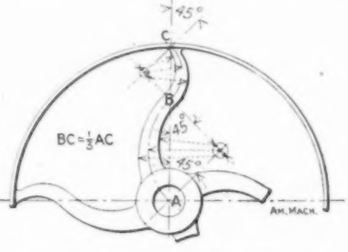


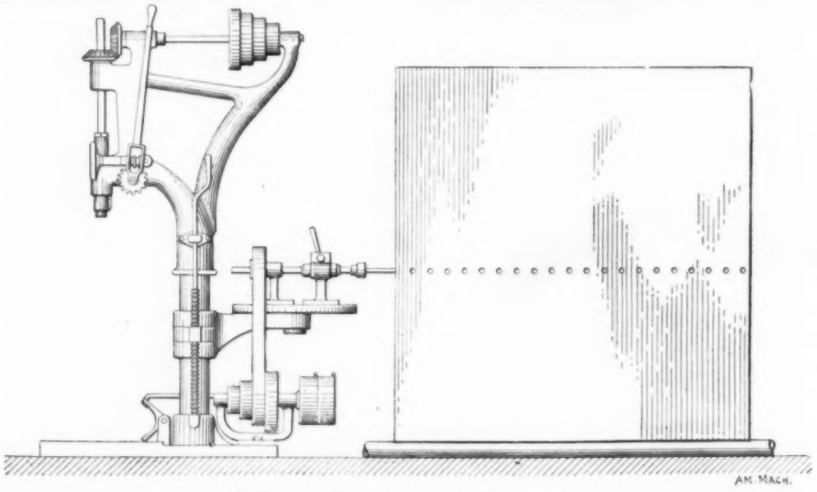
FIG. 4. ANOTHER METHOD FOR DRAWING PULLEY ARM

A Big Job on a Small Driller

The accompanying sketch shows a job which was done in a small shop when it was necessary to get it out quickly and at no great expense.

The problem was to drill a number of holes around a square tank, the holes being too high to allow the tank to stand on end under the drill. The belt of the driller was taken off, so that the table could be swung around to the position shown in the line cut. The spindle and spindle brackets were then taken from our largest sensitive driller and these were bolted seeurely to the table as shown, belting from the lower cone to the pulley on the sensitive drill spindle. I mounted the tank on rollers, and since it was quite heavy and the holes only ⅜ inch, got through the job in a very good time.

Buffalo, N. Y. F. C. LE MESSURIER.



A SMALL DRILLER ON A LARGE JOB

Canada is by far the largest market for automobiles exported from the United States. Of approximately 9000 machines exported in the seven months ended with July, 3724 went to Canada; 1875 to the United Kingdom; 938 to British Oceania (chiefly Australia and New Zealand); 477 to Asia and Oceania other than British; 444 to South America; 273 to France; 175 to West Indies and Bermuda; 147 to Mexico; 137 to Italy, and 73 to Germany. These figures do not include the shipments to non-contiguous territory of the United States, the number sent to Hawaii in the seven months in question being 202; to Porto Rico, 154, and to Alaska, 2.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Does It Pay to Re-make Milling Cutters

The article on "Homemade Standard Tools," by Robert Shaw on page 75, Volume 34, Part 2, puts the above question.

Whether it pays to re-make milling cutters is really a question that cannot be settled by generalizing, because each factory must be considered by itself and in relation to its product. In some establishments although much milling is done it is all of a plain description and can be done with small, plain mills; these then are their standard tools. Other plants may be working on much more intricate milling and consequently their standard tools will be very different to those in use in the last mentioned shop.

Therefore, to be thorough we ought to define "Standard Milling Cutters."

Perhaps someone will oblige.

On the general question as to whether it pays to repair milling cutters, I have an open mind, but on the question as to whether it pays *us*, I can say most emphatically, Yes!

We make our own milling cutters, and although we use many brands of steel, each cutter is plainly marked with the brand it is made from, consequently, *we know the heat treatment that will give good results*, and our losses in re-making are negligible, although I cannot give figures.

Whether we should have the same success in remaking *bought* cutters is very much open to question because *we should not know the steel*, and this is probably the reason why the firm quoted by Mr. Shaw has dropped remaking its cutters—it did not understand the heat treatment, hence the high percentage of failures. This is no reflection on the hardener, because an essential to successful hardening is a knowledge of the steel, and in *bought* cutters one may have four or five brands without knowing it.

While I quite agree with Mr. Shaw that milling cutters should be kept as small as possible—not only to reduce first cost, but also because of their higher efficiency—it must be remembered that the size of the cutter is governed to a large extent by the product.

Saving Effected by Repair

For a concrete example let us take a standard slab mill 4 inches diameter and 6 inches long, made from high-speed steel. When this needs remaking it would probably make a slab mill 3½ inches diameter. To make a cutter this size we must use 3¾-inch stock and the weight of a new piece would be, say, 18 pounds. Taking the price of the steel as 1 shilling 4 pence (32 cents) a pound, then the value of a new blank would be 24 shillings ($6).

Then as to the cost of remaking; the cutting could be done on the milling machine in an hour, and if it was a roughing cutter, the gashing could be done on the tool grinder also in one hour. Then we have to harden, sand-blast, and grind it. For this small outlay we get a very valuable cutter.

Again I ask, is it worth while?

There is one slight difficulty in remaking milling cutters of this type from high-speed steel: In the rehardening the bore expands, but this may be met by having arbors over standard size, and although this may appear wrong as it means more arbors, it has advantages, inasmuch that when an arbor gets bent it can be reground to standard size. In connection with the recutting of these tools it saves time to have the lead of the spiral stamped on the cutter, so that the wheels can be put on and cutting commence without loss of the time that would be required to find the spiral.

As to the smaller cutters; it is more difficult to show a money saving here, because the cost of production and the cost of steel are more nearly equal in the case of new cutters.

We work a system of exchange with our small tools and when the foreman of a shop wants new cutters he gets them by sending up a tool card (requisition) together with old cutters in exchange; thus we get the old ones back.

These are sent into the tool forge to be annealed and are then thrown into a bin and allowed to accumulate.

It frequently happens that a few special cutters are required in a hurry as the job is on the machine. The critic will say "bad planning." So do I, but the ideal planning is not yet. On such occasions we go to our bin of old annealed cutters and find something that will require little time to get ready to fill the order, thus effecting a saving of time and money.

When a boy wants a job we send him out a gross of these old cutters and he turns up the cutting part, recups and recenters the ends, and *transfers the brand of steel*. When another boy wants a job he mills them, a machinist looks them over and they are passed through for hardening, the total cost being insignificant.

In a department the product of which ranges from "gun sights for Dreadnoughts" to "camp kettles" these repair cutters are of extreme value because of the variety of size, length, etc., and failing these we should have to carry a huge number of sizes, *or alter standard cutters*.

Yes, it pays *us* to repair our cutters!

Mr. Shaw raises an interesting point as regards automatically deepening the cutter each time it is ground, thus doing away with repairs.

This would be advantageous because we should always have the same chip room, consequently fewer breakages. The only trouble I can see would be to keep the cutters cool, a hard wheel being a necessity, and if cooled with water, either the process would be slow or we should have checking with subsequent disaster. But as a believer in grinding I should say we may look forward to this machine in the near future, and the wheelmaker will supply the wheel.

Walter G. Groocock.

Woolwich, England.

The Suggestion System

I have been much interested in the different articles which have appeared recently in the American Machinist regarding the suggestion system and I believe that too much can not be said in favor of it.

In a shop where I was recently employed everything possible was done to give the men a square deal. In a box, conveniently located, were envelops with a small stub attached. This stub was retained by the man depositing the envelop containing the suggestion, and thus it was decided according to its merits only.

The deciding committee consisted of the superintendent, foreman, cost-department man and two of the men employed in the shop. The committee had no way of knowing who made the suggestion and after making the awards the numbers on the envelops were posted in the time clerk's office and the men holding the stubs with the corresponding numbers, handed them to the time clerk, who gave them receipts. That was all there was to it until pay day, when the envelops told another story.

This method does away with the remarks of the men who say: "Well, they know who wrote it or I would have gotten more money." It has certainly proved a money maker in this shop and has also brought the men in close touch with the firm. Knowing that a good idea means an increase in the pay envelop, they become more interested in their work and in increasing production, a feeling which every firm should try to encourage.

Brooklyn, N. Y. GEORGE MYERS.

Factory Lighting

The admirable series of articles which have appeared in the AMERICAN MACHINIST on the artificial lighting of factories has interested me very much. The consideration of the importance of efficient artificial lighting should not, however, blind owners and managers of factories to the usually much greater importance of arranging buildings, windows and machinery in such a manner as to obtain the highest efficiency from sunlight. In most factories the artificial light is used even in December and January only about two or three hours per day, work being performed by daylight during the remaining six or seven hours; therefore, from a quantitative point of view the problem of getting good daylight is most important, and moreover, getting good daylight usually involves only first cost, as the cost of maintenance is practically nothing. Finally, if good daylight is obtained, the period during which artificial light must be used is reduced and the gas and electric light bills cut in the same ratio.

I am not a lighting expert but merely a toolmaker who has worked in many shops and has refused or quit more jobs on account of the bad light in the shops than for any other single cause. I know of nothing more trying to the eyes and nerves than to lay out a jig or die in the gloom called daylight in some shops.

Almost half of the factory buildings now being erected in or around New York have opaque-glass windows. This opaque wired glass saves a few cents on the insurance premium per hundred dollars, no doubt, but how much does it cost in artificial lighting, spoiled work, and mens' eyes prematurely old? I once worked for six months on laying out jigs behind a large window of opaque glass. The work was done under considerable difficulty and consumed an immense amount of time. Six months under such conditions made my eyes so bad it took about a year working in a well lighted shop to bring them back to normal condition.

I know a shop in Brooklyn, built within the past year, where the toolmakers have to take their work to the open door of the fire escape to see the crosslines. The windows are large enough but are of opaque wired glass and do not come down within a foot of the bench. First-class work is impossible in such a shop.

All the men I know who have worked behind this opaque or frosted glass complain about it. It does not seem to cause eye strain to some, but all kick about the depressing and dungeon-like effect upon the mind, and many men will quit and accept lower wages to work in a light, cheerful shop. In my experience, the most desirable shops are those having large, transparent-glass windows, white ceilings, clean floors, clean benches, and machine tools painted white. The employer has the advantage of low lighting bills, good work and plenty of it; while the employee, proud of the good work he accomplishes, is happier and relieved from eye strain.

FRANCIS J. BADGE.

Brooklyn, N. Y.

Chambers Method of Paying Workmen

The article on page 217 referring to paying of workmen spurs me on to describe a system inaugurated some years ago at the works of the Straight Line Engine Company, Syracuse, N. Y., by the superintendent, F. G. Chambers.

The scheme was meritorious not only on account of the money advantage, but the harmonious conditions it maintained between the men and the company, and its after effects on the men.

It was the contract system, contract between the company and each man who was to do the work, and in which the workman had half the say about it.

As an example, the superintendent would say to a man: "Billy, we want ten more of the 13x13 pistons made. What will you make them for?" If they could agree he would give him the contract, if not, would question another man, but they usually agreed, and the contract was a contract. If the man made money, he got it; and if he lost, he lost it. There was no making up of wages (except in the case of a new man in the shop, or one unfamiliar with the work), which in my opinion, is one of the weak points in both the piece-work and Halsey's premium plan. Another thing about it was that none of the other workmen knew whether the workman made or lost, unless he told and they did not tell.

When the question of price for another lot came up each party had as much information about the job as the other, and if the man had thought up another scheme or jig whereby he could do better he could make it and own it, or the company could make it and own it. If a new machine came in it simply led to new conditions.

The men learned to keep their machines in the best of condition—not to spoil the work, they learned what work was worth, in fact it made contractors of them. It brought out the best in a harmonious way. A man would run all the machines he could handle on the job. The contracts were usually verbal. The men stuck to their contracts as honestly as the company—it made contractors, and in a sense business men of them and as a result, which some proprietors might not like, at least a dozen of these men have gone into business for themselves, none into the same business, some not even into the machine business.

While not making the superintendent any less of a man, it lifts up every man who takes a contract; it lifts the man who needs lifting most.

It may put some men so high that we cannot afford to keep them, but why not? What is life for anyway?

I have written the story in the past tense for a reason which would take too long to explain, but which contains nothing that detracts from the merits of the plan.

Syracuse, N. Y. JOHN E. SWEET.

The Science of Inventing

I have been especially interested in the discussion of the question as to whether a course of study in the science of invention could be profitably established in our technical schools, especially since in my book on "The Art and Science of Inventing," published over 20 years ago, I emphatically recommended such a course.

The articles I refer to are especially valuable in that they distinguish between creating a talent for inventing and studying how to invent. No one can create a talent for painting, composing music or any other fine art, but it is nevertheless true that artists seldom meet with success unless properly trained.

If such strides have been made in invention without inventors being taught, imagine the results that would be attained should all technical schools teach the subject.

EDWARD P. THOMPSON.

Washington, D. C.

One day the manager of a machine shop, who was running through the pages of a technical paper, exclaimed to his foreman, who was standing near, "Here's something new that looks pretty good to me; what do you think about it?

"Why, I know a lot about it," replied the foreman. "Only last night I was telling my wife how we could make good use of that here."

"Telling your wife," exclaimed Mr. Manager, "what in blazes has she got to do with it? She doesn't run this plant. Why don't you come to me? I don't want to run a back-number shop, and I am depending on you as a specialist to keep me informed."

The lesson taught the foreman that knowledge without action is like a motorboat without gasolene—*you don't get there.*

Producing Power from the Sun's Rays

By A. D. Blake

By the use of stationary mirrors the sun's rays are directed against a sheet-iron vessel containing water. This is changed into steam at atmospheric pressure, which is used in a low-pressure condensing engine for pumping water. The commercial practicability of the apparatus depends upon its performance in tropical regions where fuel is expensive.

It has long been recognized that all forms of energy owe their existence to the sun, but the ways in which this solar heat is converted into useful energy are many and often complex. For instance, the potential energy in coal may be traced to the action of the sun upon growing vegetation centuries ago. The coal is burned in a furnace and through its chemical union with the oxygen of the air, the energy is liberated in the form of heat which, in turn, converts the water into steam capable of performing useful work.

The direct utilization of the sun's rays for producing useful work, however, has been tried from time to time and, although proving feasible, heretofore has not been commercially successful.

The most recent sun-power development is that invented by Frank Shuman, of Tacony, Philadelphia, who now has a plant erected at that place for testing purposes. Early in his investigations Mr. Shuman recognized that to obtain the maximum power from the sun's rays would necessitate apparatus of such complexity as to render the cost prohibitive. He therefore decided to sacrifice efficiency for cost and designed a plant which would operate at a mean between the two.

It has been calculated by scientists that, theoretically, the maximum heat obtainable from the sun's rays at the equator is about 204 B.t.u. per square foot of heat-absorbing surface. This would decrease with latitude north or south and at Philadelphia would be only about 40 per cent. of the solar constant.

In actual tests at Philadelphia, obtained by weighing the water and taking temperatures, as high as 88 B.t.u. were absorbed per square foot of absorbing surface. From the foregoing it would appear that close to 150 B.t.u. per square foot of heating surface might be expected in the tropics. This would be equivalent to an efficiency of about 70 per cent., which compares favorably with that of an ordinary steam boiler.

The plant in its present development consists of an absorber or low-pressure boiler, a low-pressure steam engine, a condenser and auxiliaries.

The absorber is made up of a number of units, each consisting essentially of a rectangular chamber for water and steam, inclined at an angle with the horizontal, and two flat mirrors for reflecting and concentrating the sun's rays. The steam and water chamber, which is of sheet iron painted black to absorb the heat, is set on a flat wooden box covered with two layers of glass with a 1-inch air space between, and a 2-inch layer of granulated cork on the under side. This is to prevent conduction and convection of heat away from the absorber. It is obvious that the greater part of the heat utilized from the sun is radiant heat.

The boxes are mounted in frames and are arranged on a quadrant so that their angle with the horizontal may be altered. These adjustments are made once a week.

The feed water is led into the bottom of the water chambers and steam is taken from the top and conducted to an 8-inch main. All the absorbers are connected in multiple as regards both the steam and feed-water lines, and a connection between the two permits any condensation in the steam to drain back into the feed water. The individual connections to each absorber are lead pipe in order to afford flexibility when adjusting the angle of the frames. All the piping is insulated with hair-felt covering.

The entire system is closed and a back-pressure valve blows off when the pressure rises above atmosphere. While the temperatures attainable in the absorber are such that pressures much higher than atmosphere might be employed, such pressures would have required stronger construction which, in turn, would have made the cost much higher and rendered the device commercially impracticable. It has been found that the pressure can be regulated to a large extent by the level of the water in the absorbers and this is controlled by the feed pump.

The engine is of the single-cylinder condensing type, 36x36 inches, running at 150 revolutions per minute and especially designed for running on low-pressure steam. Separate inlet and exhaust ports are employed with large port areas and the clearance is reduced to a minimum, thus materially reducing the cylinder condensation and permitting the engine to be run with very little compression.

An ordinary surface condenser is employed and vacuums up to 28 inches have been obtained. The air pump and the circulating pump are belted to the main engine and for starting up the air pump is thrown onto a small gasolene engine; this arrangement, however, is only temporary.

The condensed steam after leaving the condenser passes through a separator, then to a settling tank which removes any entrained oil. However, should any oil clog up the small space between the plates of the absorber, these plates may be easily removed and cleaned.

The engine at present is connected through a chain drive to a reciprocating pump which delivers water to a standpipe against a head of 33 feet.

From actual tests made at Philadelphia in August, 1911, it is reported that from the absorber of 26 banks of units, each containing 22 single units and having a light absorptive area of 10,296 square feet and an actual area of 5148 square feet of steaming surface, there was developed during eight hours 4825 pounds of steam, the amount per hour varying with the time of day. The present plant is rated at 100 horsepower based upon tropical conditions, where not only is a greater percentage of the solar constant available but the temperature difference between the outside air and the steam is so much less as to reduce considerably the condensation. The maximum indicated power developed at Philadelphia has been about 33 horsepower when delivering approximately 3000 gallons of water per minute.

The estimated cost of the entire plant is $200 per horsepower. This, together with the large area covered in proportion to the small power developed, would render competition impracticable with steam- or gas-engine plants except in tropical regions where fuel is expensive. In fact, these are the conditions which the device is designed to meet and no claims are made outside of this field.

It is stated that the plant now operating at Tacony is soon to be taken down and shipped to Egypt, where it will be erected for irrigation work. It will then be working under the conditions for which it was designed and its commercial value will then be put to test.

An apparatus for controlling signal semaphores at a distance from the controlling station has been developed for use in train despatching in connection with the telephone despatching used on many lines of steam and electric railway. This apparatus has been perfected by the Western Electric Company, New York, in conjunction with the Union Switch and Signal Company, Swissdale, Penn.

Aviation Meet Features

By Charles H. Colvin

The second international aviation tournament held at Nassau Boulevard, Long Island, September 23 to October 3, while not resulting in the establishment of any new world records, as aëroplane records go, brought to public attention several developments in aëroplane construction and design.

The Nieuport Monoplane

The most striking departures in construction are seen in the Nieuport monoplane. This is credited with being the fastest flyer in the world, and is the machine used by Weymann in this year's International Cup Race which he won for America.

The shape of the body at once attracts attention. It is entirely covered-in, except over the pilot and passenger seats, with aluminum in front and cloth elsewhere. Its general lines resemble those of a torpedo, being largest about one-fourth the length from front to back, tapering off round in front and nearly to a point at the rear. The body is of rectangular cross-section throughout, and is about 25 feet long over all.

The wings, which taper slightly to the ends, are set at 180 degrees to each other, and have a peculiar cross-section which is very similar to the shape of the body. The wing-ends are slightly rounded.

The tail consists of a semicircular horizontal plane, to the rear edge of which are hinged two smaller semi-circular elevating planes, with space between them for the rudder, which is square with the rear corners rounded. When the machine is on the ground the tail is held in the air by the weight of the motor in front.

The running and landing gear is unique. The construction is entirely of steel tubing, and consists of a long central skid, turned up at both ends, with wheels mounted about a third of the way from the front, at each end of a nearly straight semi-elliptical leaf spring. Lateral control is by warping. The machines at the Nassau meet were Gnôme-driven, although the Nieuport has flown with a two-cylinder 28-horsepower motor.

Another New Monoplane

Another monoplane new to America is the Déperdussin. In general appearance it reminds one of the Antoinette though it is much smaller.

This machine also has an inclosed body which is much thinner than that of the Nieuport. The planes taper somewhat and are square on the ends. The fixed tail is triangular with the vertex forward. To the rear edge of it is hinged a rectangular elevator. Above the horizontal tail is a smaller triangular vertical fin to the rear of which is hinged the square rudder.

The running gear is made up of two skids, and a pair of wheels on an axle elastically attached near the rear of the skids. A curved skid holds the tail off the ground while at rest. Warping is employed for lateral stability and an Anzani motor is used. At a distance the machine reminds one strikingly of a "darning-needle."

Biplane Developments

Of the new features in biplanes two are noticeable on the Curtiss machine. The new Curtiss tail, shaped like two mowing-machine-cutter blades, is operated in conjunction with the front single-surface elevator, whereas the old rectangular tail was fixed.

Another Curtiss innovation is the military machine with two seats side by side. The steering-wheel post is hinged at the base to swing to three positions; right, center, and left; for use of either man or of one man flying alone. With one man only, the double seat is replaced by a single one in the center.

Also new to this country is the Headless Farman biplane. It has very short under wings, and a large extension on each of the upper. A single horizontal surface in the rear is used for elevating. At each end of this plane, and just below it, are placed comparatively small vertical rudders. The operator sits several feet forward of the lower plane on a wicker seat in a wooden framework.

Turin Exposition

In that section dealing with Italy's exhibit of the report covering the Turin Exposition, published at page 390, Volume 35, the statement that the Bickford type driller, the Jones, Pollard & Shipman driller and the Herbert combination lathe were exhibited by the Ansaldi firm is misleading inasmuch as these three types of machines were on the stand of the Dubosc firm.

Apprentice School in the Far West

In connection with its shops at Oakland, Cal., the Southern Pacific Railroad Company has established a school for the education of apprentice machinists. A building to be devoted exclusively to class-room instruction has been erected, and fully equipped with all essentials necessary to further the work. A library is maintained in conjunction, and a special instructor has been appointed to supervise the course of training. Class-room work is supplemented by practice in the shop, all tools and necessities for complete performance being furnished by the road.

The institution is similar to others which the Southern Pacific Railroad Company has in operation along its lines. This is stated to be the only road organization west of the Missouri river which so provides for its shop apprentices.

Lock Washer Standards Adopted by Automobile Engineers

These standards were recommended by the Society of Automobile Engineers' standards committee and accepted by the Society of Automobile Engineers, June, 1911.

Diameter Dimensions

The outside diameters of lock washers shall coincide practically with the long diameters of Society of Automobile Engineers' Standard nuts, which are approximately the short diameters of United States Standard nuts.

The inside diameters of the lock washers shall be from 1/64 inch to 1/32 inch larger than bolt diameters.

All lock washers shall be parallel-faced sections; and bulging or malformed ends must be avoided.

Automobile Heavy (A. H.)

Bolt Diameter	Lock Washer Section	Bolt Diameter	Lock Washer Section

Automobile Large (A. L.)
For Optional Use Against Soft Metal

Bolt Diameter	Lock Washer Section

TABLE OF SIZES

Temper

After compression to flat, reaction shall be sufficient to indicate necessary spring power, and on a subsequent compression to flat the lock washer shall manifest no appreciable loss in reaction.

Toughness

Forty-five per cent. of the lock washer, including one end, shall be firmly secured in a vise, and 45 per cent., including the other end, shall be secured firmly between parallel jaws of a wrench. Movement of the wrench at right angle to helical curve shall twist the lock washer through 45 degrees without sign of fracture; and shall twist the lock washer entirely apart within 135 degrees.

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OUTLINE OF TOPICS, PAGE 137

American Machinist

Machine Tools as Power Users

Is the efficient use of power any less important than its efficient generation?

Ingenuity, labor and expense are not spared to increase the efficiency of a power-generating plant by so little as one-half of 1 per cent., but small consideration is given to the machines driven from this same plant, as regards the efficient use of the power produced.

To narrow the question a little, how much is known about the mechanical efficiency of machine tools? Very little, we venture to reply.

No designer would admit that he did not strive to develop an efficient machine tool; likewise no builder would admit that his product was inefficient as mechanisms go. But what are the facts?

A recent article shows an efficiency of 13 per cent. in a certain case. A. L. DeLeeuw, in presenting the results of some miller tests before the American Society of Mechanical Engineers in 1908, shows mechanical efficiencies for the feed mechanism of three different No. 3 millers to be 19, 13½ and 8 per cent. respectively. In the same paper he gives efficiencies of the driving mechanism of No. 4 millers ranging from 67 to 79.7 per cent. We know of no better values than the highest here given, and believe that many, were they known, would be found to be lower.

It may be argued that a machine tool should be considered only in relation to the quantity and quality of work that it will do, not in relation to its consumption of power. This is a short-sighted position to take.

Mr. DeLeeuw in the paper referred to presents the argument against the inefficient machines by pointing out that they:

(a) Use a needlessly large amount of power.

(b) Have less capacity than they might have for removing metal.

(c) Use a large amount of power constantly for the purpose of breaking down the machine.

The aim of the designer and builder should be to produce a machine with a maximum efficiency, both as regards turning out product and as regards its own mechanism. Following this aim tends to the economical use of power, an increase in metal-removing capacity and freedom from wear and breakdowns.

We would welcome data showing the mechanical efficiencies of machine tools both as regards driving mechanism and feed mechanism, believing that the presenting of them would tend toward improvement.

Surmises

A well known Chicago manufacturer, having decided that all colleges are unfit to exist, has unearthed what appears to him to be exclusive evidence that college boys are bad. Unspeakably bad, if the published facts are so much milder than the rest that the post-office department would not allow the latter to be sent through the mails. We have no data bearing on this subject to offer, but we wish to call attention to the rapidity of the reform which these boys undergo upon graduation. Certainly more than 5 per cent. of the college graduates remain sober quite a bit of the time, and the 15 per cent. who become habitual drunkards must die during their commencement exercises.

We cannot help but wonder if the investigator did not find what he was paid to find, and we wonder if he was not aided by some rather waggish pupils who gave him their assistance. We must confess with deepest regret (?) that we once stooped so low as to create the impression in prexy's mind that the whole crowd drank itself under the table, when the only thing in the room stronger than ginger ale was the label on the bottles. Of course, that was not at Harvard, but it was at a place where the investigator might have surmised many of the same things that he surmised about some of the places where he surmised.

Speaking as seriously as one can on a ludricous subject, the results of college training seem to indicate that this investigator was badly loaded—at least with stories—for the average college graduate shows signs that he has passed through something of a character-building epoch in his life. The greatest disadvantage that a technical graduate appears to have as compared with a college man, lies in the fact that the latter knows men while the former knows materials only. The most important engineering work of modern time arises from the growth of industrial undertakings beyond the one-man power to the stage where coöperation of many men is necessary. It is in this field that the college man has shown his ability to outshine the technical graduate, no matter how necessary the latter may be to the success of the mechanical side of the undertaking. Technical schools may well take note of this.

Fortunately, the Chicago man above referred to so overshoots the mark that he is likely to cause little anxiety to our technical schools or other institutions of higher learning.

The Demand for Industrial Education

It is a favorite topic for the advocate of industrial education to cite the great demand that is sweeping over the country for education in the trades. The position of the AMERICAN MACHINIST on the question of training for the trades is too well known for us to be misunderstood when we say that so far we fail to see any "demand" for it. What is present is a great and still growing feeling on the part of men that two things are needed. One that the manufacturing plants of the country are, or soon will be, in need of more skilled workmen than modern methods of shop management will allow them to produce themselves; the other, that there are large numbers of men and boys who are unable to get a square deal because they are shut out of profitable industries by this same change in the methods of production.

The curious thing is that neither of the parties to be benefited by the movement have any considerable part in it.

Where schools have been started it seems to be proving true that manufacturers have taken little or no real, lasting interest in them, nor has the suffering

public shown any uncontrollable tendency to take the place by storm.

Every school has grown around some one or two men who have persuaded the public to try an experiment, which almost everybody concedes to be a praiseworthy one, but into which few men are really willing to put any time and thought. So we find that industrial education is being fathered from the outside, that the men of note who are willing to spend the time to laud it in a general way are not willing to get near enough to earth to work out its details. Perusal of the reports of the Society for the Promotion of Industrial Education, and those of the many commissions that have studied the matter confirm this belief, for they leave one enthused over the possibilities but asking the question, "How?"

It is said to be one of the distinguishing marks of a genius that he shall have an infinite capacity for small things. Where is the genius that will rise to the small things of industrial education?

New Publication

Principles of Industrial Management. By John C. Duncan. Three hundred and twenty three 5x7¼-inch pages; 59 illustrations; maps, diagrams and blanks. D. Appleton & Co., New York and London.

The title of Professor Duncan's book is perhaps not very well chosen, since it deals with a much wider range of subjects than is generally included under the head of management, while on the other hand it is in no sense a mere guide to the art of management. In fact its chief claim to attention is that it is not a practical handbook for the manager, still less does it aspire to dictate particular methods of administrating a plant. It belongs to that comparatively rare class of books which combine a wide survey of methods and conditions with an analytical study of their underlying principles.

The subject of the book is industry as a whole in its many types and varieties, and a not unsuccessful attempt has been made to marshall all the chief characteristics of industrial enterprise into a comparatively small number of groups. The book commences with a "general theory of industrial location," based on natural resources, a theory of plant location and the ideal situation for various kinds of plant. Chapter V deals with "Business Concentration and Integration" and discusses the reasons for it. Chapter VI discusses specialization and its limitations.

In Part 2 is found a very interesting discussion of the structure and layout of plants, in the shape of an analysis of industries into three main types: Continuous synthetical industries, such as textile mills and steel-making plants in which "the raw materials go into one end of the plant and pass through various machines and processes without halting at any stage for other finished parts to be brought to them;" continuous analytical industries, such as sugar refining and meat packing, in which the original material is being subjected to a continuous process of subdivision or analysis; assembling industries, such as shoe factories, shipyards and machine shops, in which "the final product is made by first producing the ingredients or parts and then assembling them together." These chapters perform the service of making known, in a compact shape, the forms and problems of other types of industry than our own, in what might easily prove to be a suggestive manner. Chapters on fire precaution, the building and the workers, and the power problem, follow.

With Part III we enter on a discussion of types of organization and management, using the latter term in its more usual and limited sense. Here we are on ground familiar to readers of the American Machinist, since Professor Duncan confines his discussion chiefly to engineering and machine-shop examples. At the outset we find very interesting matter, viz., an analysis of the "Three Types of Organization," defined respectively as "military," "functional" and "departmental" systems.

It is interesting to note that Professor Duncan's opportunities of observation do not incline him to an enthusiastic indorsement of this portion of Mr. Taylor's "science" of management. After enumerating the advantages claimed for the method, Professor Duncan says: "Notwithstanding all these advantages the functional system of organization has not proved popular or successful in a number of plants where it has been tried. It causes men to lose initiative. It has a tendency to shift and divide the responsibility in spite of the contrary intention. The difficulties that have been encountered in carrying the scheme through are:

"(1) It requires a great amount of clerical work to fill out instruction cards and write out all orders and minute instructions necessary for the complete enforcement of the scheme.

"(2) It is exceedingly hard at times to define clearly to whom certain functions belong and on whom the responsibility rests when things go wrong. For instance, no less than eight bosses outside of the shop disciplinarian come into direct contact with the men. Four of these make out instructions, and four others say how they should be carried out. It not infrequently happens that the man who makes out the instructions is somewhat vague in his directions, in the hope that the speed boss or the gang boss will make up deficiencies. If a mistake occurs under these conditions, it becomes a difficult matter to determine who is to blame, because the instruction man will plead that they were not interpreted correctly and the other bosses will assert that such interpretations could be made. Sometimes the instruction-card man will give instructions and the gang bosses may see a better method. If they do, the chances are that they will want to put their scheme into operation. Hence there will be a conflict of authority. If a boss adheres to the system and does not follow the best method possible under the circumstances, the firm is paying for a system management which is failing in its purpose of getting the goods out in the cheapest possible manner.

"(3) It is cumbersome and expensive to operate. In every shop the job must be assigned to men at all kinds of odd times during the day. If a workman desires to start on his job he must come into contact with at least three of those bosses before he can do anything. There are usually several men desiring jobs at one time. Under a system where the workman is supposed to know how to set up a job and interpret instructions, he merely needs to find out what he is supposed to do, and do it, calling on the boss only when there are complications. With this functional scheme he is not supposed to act on his own initiative. As a matter of fact so many bosses really hinder the work. They irritate the men and are expensive to keep up, because in a shop they must have a number of sets of bosses to carry out the scheme as laid down."

This criticism goes to show that no "system," however "scientific," is independent of human nature.

Subsequent chapters of the book deal in an interesting and informing manner with such subjects as the labor force, payment of the workman, employing men, timekeeping, records of stores, of finished stock, of equipment, in each case giving a resumé of the various methods usually met with and discussing their advantages and defects. We do not know of a more useful book than this to place in the hands of an aspiring young man, because it gives clearly and forcibly an idea of the wide range of modern industry. He must have a dull mind indeed, who could fail to be inspired by Professor Duncan's presentation of the subject.

Personals

J. H. Emerson, employed by the Wheeling Mold and Foundry Company, Wheeling, W. Va., during 1910, is requested to communicate with that company on a matter of importance to him.

Halsted Little, for many years associated with the sales department of Manning, Maxwell & Moore, has been appointed eastern sales agent for the Detroit Twist Drill Company, with offices at 30 Church street, New York City.

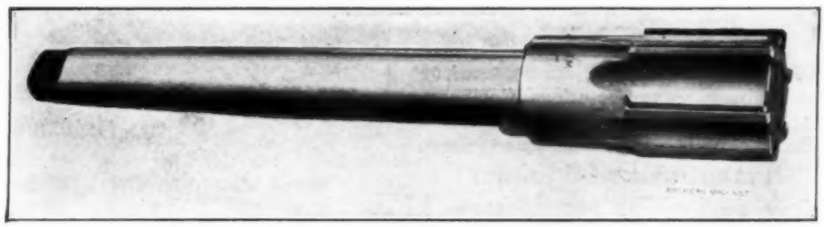
Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Adjustable Reamer

The halftone herewith shows a new design of adjustable reamer, recently developed by Messrs. Vickers, Ltd., London, S. W., England.

The reamer is designed to be used for a roughing as well as for a finishing cut. The number of reamer components is five, and consists of a shell, cone bolt, retaining ring, lock nut and blades. The largest component is the shell, which is of mild steel, slotted and recessed to receive the cone bolt and blades. The practice of backing up the side of the blade and leaving the cutting face clear has been retained. The top of this shell is recessed to receive the key of the Morse taper or cylindrical arbor. The cone bolt is hardened and made of tool steel. The actual cone on which the blades rest is interrupted and threaded to take the collar, so that the internal edge of the blade rests on two truncated cones.



ADJUSTABLE REAMER

The lower end of the cone bolt is graduated and each division corresponds to a fractional part of an inch variation in the diameter of the reamer. The other end of the bolt is threaded to take the lock nut. The collar screws onto the parallel and threaded part of the cone bolt and has a blind keyway which engages with a small pin let into the shell. The collar is thus fixed with regard to the shell and any rotary movement of the cone bolt results in its displacement in an axial direction. One face of the collar is beveled to take the tongue of the blades and so retain them in position. The blades are strips of carbon or high-speed steel and are wedge shaped, so that the cutting edges are parallel when the blades are resting on the cone belt. They are also recessed so as to ride freely over the collar.

To adjust the diameter the operator, after dismounting the reamer from the arbor, inserts the box spanner and slacks out the locking nut slightly. He then places the adjusting key in the pin holes of the cone bolt and turns it slowly in a clockwise direction.

Each small division on the face of the cone belt corresponds to a ¼-thousandth of an inch variation in diameter, and each large division to one-thousandth, so that 10 large divisions must pass the zero mark to increase the diameter one-hundredth of an inch. This done, the adjusting key is removed and the lock nut screwed home, when the tool is ready for use.

It will be noted a longitudinal motion of the cone bolt results in an increase or decrease of the working diameter of the reamer without a corresponding longitudinal motion of the blades. This obviates any sliding motion of the blades relative to the reamer, as the expansion is effected directly at right angles to the reamer axis.

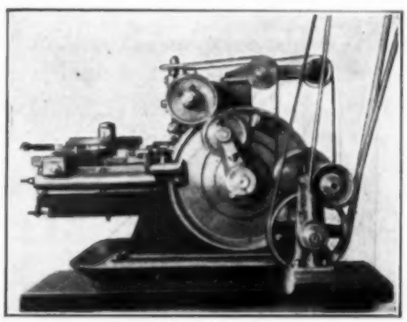
To avoid possible confusion in cases where the diameter of the reamer is being constantly altered, it will be noted that when the cam bolt and shell are flush and their zero marks in line, the actual diameter of the reamer is equal to the size in inches or millimeters stamped on the shell; it is, therefore, an easy matter for the machinist to reset the reamer to any size within its compass.

With this type of reamer over six-hundredths of an inch was removed from the walls of a 1½-inch hole, drilled in mild steel of 30 tons tensile strength, with no damage to the tool whatever.

Automatic Needle Grooving Machine

The accompanying halftone shows a sewing-machine needle blade-grooving machine recently built by the Langelier Manufacturing Company, Providence, R. I.

The construction of the machine consists of a one-piece frame, having at the top a slide cross arm similar to an open-side planer for carrying the two cutter heads. At each end of a shaft passing through the cross arm is mounted a disk side-acting segment cam for feeding each of the cutters to their proper cutting depths. The shaft is connected by spur gearing to the main master cam and makes one revolution to every cycle of the machine. The cutter heads are adjustable vertically and also laterally either both as a unit or individually.



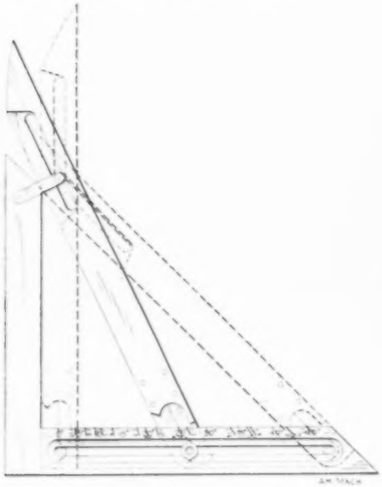
AUTOMATIC NEEDLE-GROOVING MACHINE

Both vertical and lateral adjustments are indicated by dials reading to thousandths of an inch. The cutter spindles are driven by a round leather belt and run at a speed of 1050 revolutions per minute. The lower ends of cutter spindles are supported by adjustable steady rests for resisting the cutting thrust. The grooving cutter on the left cuts the long groove on the blade and the grooving cutter on the right or rear of the machine gashes in the short groove at the finish of the grooving feed. The ejecting of the grooved needle is done instantly after the grooving operations, the needle falling into a trough that leads it to a receiving pan. The dial feeds the needle into the vise immediately after the ejecting and just previous to the return feed of the vise for the beginning of the cutting of the long groove. Four needles are grooved per minute and one operator is able to load the dials for four or five machines.

Adjustable Triangle

The adjustable triangle shown in the accompanying cut is a 45-degree triangle so arranged that one end of the hypotenuse can be slid along the base to make any angle with it between 45 and 90 degrees. At the same time the hypotenuse makes angles between 45 and 0 degrees with the upright leg.

The base member of the triangle has a slot parallel to its ruling edges, in which slides a round pin fixed to the end of the hypotenuse. The upper end of the hypotenuse is slotted and slides on a pin fixed to the end of the upright leg. The blades or legs of the triangle are of maple wood and all the metal fittings of



ADJUSTABLE TRIANGLE

German silver. The end of the pin projecting up through the slot is threaded and carries a thin, modified wing-nut. A quarter turn of the nut is sufficient to free the pin or to bind it firmly at any point along the slot.

The upper end of the hypotenuse blade is cut off along a flat curve so that it can in no position project beyond the outer edge of the upright. This enables the use of the triangle with either the base or the upright against the T-square blade.

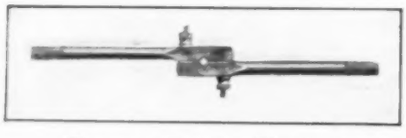
Graduations in half degrees on the upper edge of the base mark the correct positions of the hypotenuse to set it at any angle between 0 and 45 degrees with the upright.

The triangle is the product of the Adjustable Triangle Company, Post Office Box 23, Station H, New York City.

Tap and Reamer Wrench

The wrench shown herewith is made of steel and holds tight taps or reamers. It is designed to eliminate the possibility of the tap and reamer corners wearing off in use. It will be noted that the line of applied leverage is in direct line with the center of the reamer or tap, which reduces the chances of breakage.

The wrench is made in several sizes by W. A. Peck, New Haven, Conn.

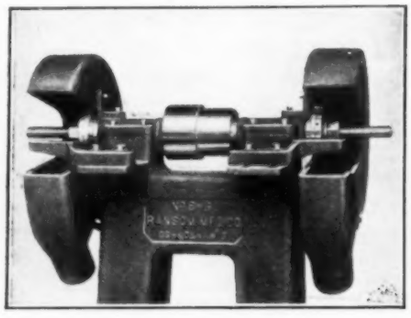


TAP AND REAMER WRENCH

Emery Wheel Guards

The emery-wheel guards shown in the accompanying halftone are made of steel castings and as will be noted combines the guard and exhaust pipe connection.

The guard is made adjustable so that as the wheel wears down it can be set back allowing the operator to get close to the wheel. The upper plate is made removable, permitting change of wheels without disturbing the main guard.



EMERY-WHEEL GUARDS

This form is a recent development of the Ransom Manufacturing Company, Oshkosh, Wis.

Patternmaker's Jointer

The accompanying halftone shows a jointer made in several sizes, on all of which the tables are 7 feet long. The table bases slide freely in grooves on the top of the frame and are held fast by binder screws operated by handwheels. The back table base is moved by hand, and the back table is adjusted on its inclined ways by the handwheel shown at the end of the illustration.

A special feature of the machine is that the front table and its base are both adjusted by the large handwheel shown near the middle. When the binders of the table base are free, the whole front-table mechanism is moved to and from the cylinder and without changing the hight of the table, by turning the handwheel. When the table base is held fast by its binders, the same handwheel adjusts the elevation of the table on its inclined ways.

The cylinder is a steel forging and is carried on a yoke that is machined true with the top of the frame, and bolted and doweled in place. The bearings are self-oiling.

The fence is operated for beveling by the small hand crank shown in Fig. 2, which operates a pair of spiral gears

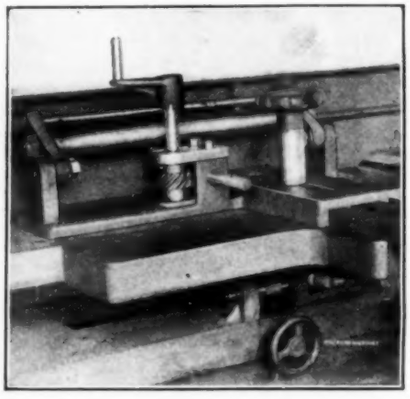


FIG. 2. FENCE-OPERATING MECHANISM

which turn a screw that draws the fence about a swinging fulcrum, carried by a pair of links, producing any angle up to 45 degrees. The fence bracket is bolted to the edge of the front table and the fence freely moves across the table, guided by telescopic or compound slideways, binders holding it in any desired position.

The machine is a recent product of the R. M. Root Company, York, Penn.

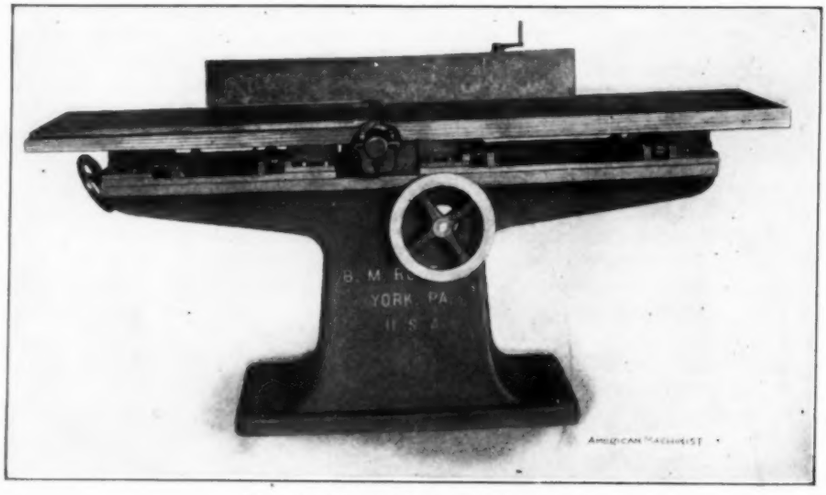
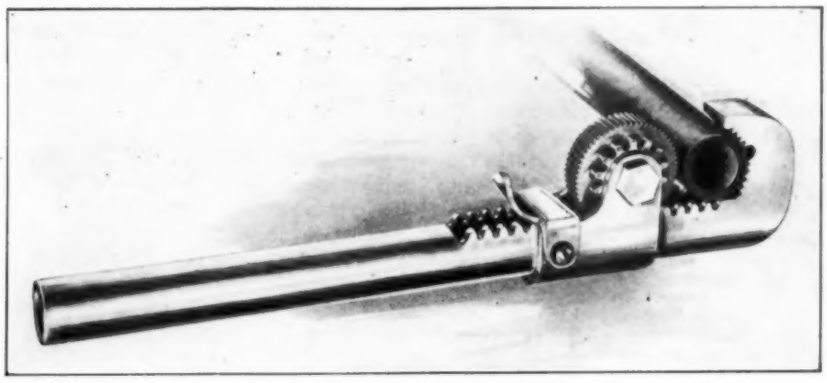


FIG. 1. PATTERNMAKER'S JOINTER

Combination Wrench

The accompanying halftone shows a wrench designed for pipe and other work recently developed by the Atwood Wrench Tool and Stamping Company, Conneaut, Ohio.



COMBINATION QUICK-ACTING WRENCH

The tool is made of cold-rolled steel, except the smaller parts which are made of tool steel, and the head is welded to the handle after the latter is formed from the flat, thus giving ample tensional strength.

The wrench will take either square or hexagon nuts, and does not have to be taken off the nut in advancing, as it rides around the edges or corners and the grip taken as desired. It is of the quick-action self-adjustable type. The clamping effect of the pipe and jaws is obtained through the rotation of a disk which comes in contact with the pipe by means of a spring pulling the saddle toward the head. Pressure on the handle causes the disk to rotate inward, the pinions attached to the disk on both sides engaging the teeth in the handle, thus causing traction toward the head. The grip is, therefore, increased in proportion to the pressure on the handle and is readily released by suspension of the pressure. As will be noted a three-point contact on pipe is obtained.

Insert Jaw Chucks

The Keystone Manufacturing Company, Clearfield, Penn., has recently placed on the market a set of insert jaws for a regular lathe chuck, designed to permit handling in the latter bolts or rods as small as ⅛ inch in diameter.

Three different sets of jaws are made, two with four jaws and the other with three jaws. The larger of the four-jaw sets will hold pieces ranging from ⅜ inch down to ⅛ inch, and even less, and the other will accommodate pieces ranging from 11/16 to 5/16 inch in diameter. The range covered by the three-jaw set is from 11/16 to ¼ inch.

Hardness Relative to Other Properties*

By Ralph P. Devries

A discussion of hardness as indicated by the Brinell and sclerescope tests in its relation to the elastic limits of the specimens tested.

"Since it has been shown that the indications of the sclerescope are a function of the elasticity within the elastic limit and of the size of the deformation produced beyond the elastic limit, it is clear that the results obtained by the sclerescope are comparable only for the same class of metals."

*Paper presented to the American Society for Testing Materials.

Of the five methods of hardness measurement compared in my first paper, only two will be considered in this paper. See page 648. They are the Brinell and the Shore methods. Knowledge of the physical properties of metals is necessary to obtain a clear conception of the significance of the different hardness tests. It is also desirable for the reason that correlation may help to avoid the introduction and use of certain tests whose results might as well be determined from some form of test already standardized.

From the complete investigation of 13 alloy steels furnished by the Halcomb Steel Company and the Crucible Steel Company, only those results will be presented which stand in direct relation to the hardness tests.

The Brinell and Shore hardness tests are alike in that they respectively measure and indicate hardness in the region of permanent deformations. In the Brinell tests the indentation is made under static pressure and the hardness is the resistance offered. In the Shore test the indentation is made by an impulsive force, but it is not evident what the hight of rebound indicates. To determine this, 30 different metals were tested by the scleroscope with three different hammers. These hammers were the universal scleroscope hammers, but the striking point of two of them were ground differently. For convenience of reference they were lettered *A*, *B* and *C*. The striking area of hammer *A* was ground so that the radius of curvature was very large. Hammer *B* was unchanged. Hammer *C* was ground to the form of a circular cone, the solid angle subtended at the apex being approximately 45 degrees. The hights of rebound obtained for each metal are graphically represented in Fig. 1. The curves are lettered *A*, *B* and *C* to correspond to the hammer used in obtaining them.

These curves assign different hardnesses to the metals tested, but do not place the metals in the same position in the hardness scale. The question then arises, why shall the hardness scale established by hammer *B* be accepted as correct?

The rebound of all three hammers is, of course, primarily due to the elasticity of the metal and the hammers, but the different forms the three curves assume show that some other variable or variables modify the hight of rebound. Since all the conditions of test except the form of the hammer remained constant in these tests, it is clear that one variable which affects the hight of rebound is the form and size of the permanent indentation made in the metal. When the hammer falls upon the metal under test it rebounds from the indentation formed. The cold working imparted to the metal increases both the elasticity and the hardness. This can be seen by allowing the hammer to rebound twice in succession from the same indentation. The second rebound is higher for all metals. For the steels under investigation the hight of rebound is increased from 10 to 30 per cent. of the initial hight of rebound.

Effect of Cold Working on Hammer Rebound

To show this effect in a different way a bar of steel was stressed in a tensile machine and the hights of rebound were obtained for the different stresses.

The data in Table 1 show that the hight of rebound did not increase for stresses below the elastic limit, but that it did increase approximately 18 per cent. of the initial rebound for the highest stress above the elastic limit.

(Elastic limit, 78,000 pounds per square inch)

Stress, pounds per square inch	Scleroscope Hardness
0	36.5
10,000	36.8
20,000	36.8
35,000	37.0
60,000	37.0
83,000	40.0
98,000	43.0

TABLE 1. SCLEROSCOPE HARDNESS OF VANADIUM STEEL FOR DIFFERENT STRESSES

Although these experiments are sufficient to show that the scleroscope responds to the increased elasticity and hardness imparted by cold working, they give no idea of the effect actually produced by cold working of the scleroscope hammer. To determine this all of the 30 metals previously tested by the three different hammers were indented with a 1.2-centimeter (0.48 inch) sphere subjected to 3000 kilograms (6600 pounds) pressure. The metals were then tested in the scleroscope with the universal hammer *B*. The hammer was

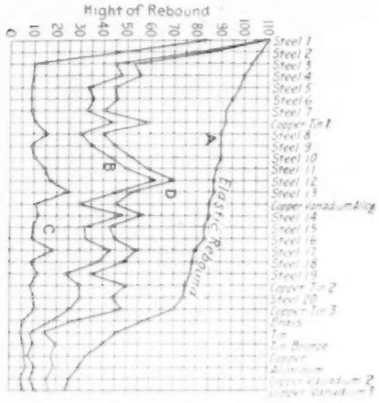


FIG. 1. HIGHT OF REBOUND FOR THREE HAMMERS

made to drop in the center of the indentation formed by the sphere. The hights of rebound are shown in curve *D* of Fig. 1. The difference between any ordinate of curves *B* and *D* is the increased hight of rebound due to cold working. The 3000 kilograms (6600 pounds) static pressure applied to the different metals cold worked them to different degrees, just as the force of gravity acting upon the scleroscope hammer induces different degrees of cold working. Curve *D*, when compared with *B*, therefore shows the effect which cold working produces. The differences in rebound on different steels are so small that the form of curves *B* and *D* are almost exactly similar. If the first rebound of the scleroscope hammer responds to the cold working it fails to explain the difference of form existing between curves *B* and *A*.

In the scleroscope the kinetic energy available for doing work on the metal under test is a constant. A certain fraction of this energy is spent in doing work of permanent deformation. The energy restored to the hammer by elasticity is the difference between the total and the amount spent in deformation, heat, etc.

Now Shore* assumes that the amount of energy spent in producing a comparatively large permanent deformation in a soft metal is greater than the energy spent in producing the comparatively small deformation in the hard metal. The energy restored by elasticity would then be less for the soft metal than for the hard metal and consequently the rebound would be less. This assumption is not substantiated by our knowledge of the behavior of hard and soft metals under stresses beyond the elastic limit. Lieutenant-Colonel Martell has in fact shown conclusively that the energy required to displace a unit volume of metal by impact of any form of pyramidal hammer is greater for hard metals than for soft metals. From the energy standpoint we would, therefore, be compelled to assume that the energy spent in producing the small deformation in hard metals might as well be equal to or greater than the energy required to produce the larger indentation in the soft metal.

The hammer makes a permanent indentation in every metal. Therefore, in some part of the indentation it comes into contact with metal stressed beyond the elastic limit and in some part with metal stressed just up to the elastic limit. The rebound of the hammer can only be caused by the recovery from strains within or just beyond the elastic limit. The energy restored to the metal must be proportional to the elasticity of the metal. This has been proved by Vincent, who showed that there is a maximum velocity of rebound whatever the velocity of impact may be. If a soft metal has a low elastic limit it might therefore give a less rebound than a hard metal with high elastic limit.

In Fig. 2 the elastic limit of 13 steels investigated are compared with the hardness as obtained by the scleroscope. These results show conclusively that there is no constant ratio between hardness by the scleroscope and the elastic limit of the material. For example, steel No. 1 has a lower elastic limit than No. 2. It shows a higher tensile hardness than No. 2; that is, its percentages of elongation and contraction are much less. Its strength is higher. Yet the Shore instrument as well as the Brinell shows that steel No. 1 is harder than No. 2. The reader can find other examples from curves of Fig. 2.

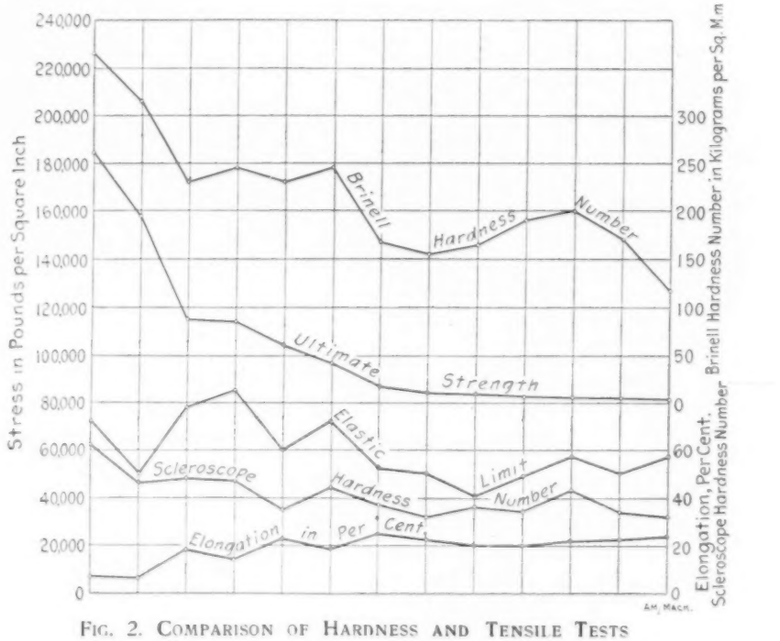


FIG. 2. COMPARISON OF HARDNESS AND TENSILE TESTS

This result was to be expected because the curves of Fig. 1 show that the size and form of the permanent indentation made by the hammer modify the hights of rebound. The regulation scleroscope hammer also produces different forms and sizes of indentation. For a hard steel the universal hammer is practically a blunt hammer; for a soft steel it is a pointed hammer.

SIGNIFICANCE OF THE SCLEROSCOPE

The significance of the scleroscope now becomes apparent. The hight of rebound which is caused by the elasticity of the metal is modified by the form and size of the permanent indentation. If the indentation is comparatively large, as it is for a soft metal, the rebound is retarded. If it is small the hammer rebounds with greater freedom. For metals like steels in the cast or annealed condition, in which the hight of rebound due to elasticity is approximately the same, the scleroscope

*AMERICAN MACHINIST, Volume 30, Part 2, page 747.

gives an indication of the resistance offered to permanent deformation. Since the modulus of elasticity of hardened steels is not different from that of ordinary steels, it may easily be seen that the detection of differences in hardness is dependent upon very slight differences of permanent indentations. This explains why hardened steels when tested by the scleroscope should have the surfaces prepared with the greatest care, and even then it will be difficult to obtain accurate results.

Since it has been shown that the indications of the scleroscope are a function of the elasticity within the elastic limit and of the size of the deformation produced beyond the elastic limit, it is clear that the results obtained by the scleroscope are comparable only for the same class of metals. It is also clear that rubber, glass, paper and similar substances should not be compared with metals because for these substances elasticity alone affects the hight of rebound.

In curve *A* of Fig. 1, there is inserted among the steels four alloys of copper and tin. The elastic hight of rebound is the same as that of steels. The fact that they show hardness equal to and greater than that of steels is, therefore, easily explained.

The relation existing between hardness by the Brinell method and the scleroscope as shown by the curves is not a constant one even for steels. That there is a relation is evident, since the Shore hardness is a function of resistance to indentation as well as of the elastic limit. For steels of the same elastic limit the relation between hardness by the Brinell and Shore instrument should be a linear one, since the hardness indications are entirely dependent on the resistance to indentation.

The Brinell test owes not a little of its importance to the fact that at different times comparative results between it and the ultimate strength of steel have been adduced to show the existence of a simple relation between the two. The investigations of Kurth have gone far to show that no simple relation exists, at least not for the two chemically pure metals which he investigated. He has shown, however, that if a metal has its elastic limit raised by repeated stressing in the tensile machine, the ratio of change in elastic limit to change of hardness is a constant for geometrically similar indentations. The curves of Fig. 2 show that no simple relation exists between hardness and ultimate strength of the alloy steels investigated.

The relation between the elastic limit and the scleroscope results has been discussed. The curves show conclusively that the hardness tests by both the scleroscope and Brinell methods agree with what is generally known as tensile hardness; that is, low elongation and reduction of area with high tensile strength.

It is noteworthy that the ratio between the scleroscope and Brinell hardness is not a constant even for the 13 alloy steels investigated.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

Metal Working

NEW ENGLAND

The National Pipe Bending Company, New Haven, Conn., will enlarge its plant.

The E. D. Blaisdell Company, Dexter, Me., is having plans drawn for a new garage.

M. H. Barnett will erect a salesroom and garage at 457 Worthington street, Springfield, Mass., to cost $12,000.

The automobile repair shop and carriage factory of Hancock & Ready, Malden, Mass., was burned. Loss, about $25,000.

The Coburn Trolley Track Manufacturing Company, Holyoke, Mass., has let the contract for an addition to its plant.

The Goodwin & Kintz Company, Winsted, Conn., manufacturer of gas and electrical fixtures, has increased its capital $50,000 for the purpose of enlarging.

Waterbury Welding Company, Waterbury, Conn., has been incorporated to make and deal in automobiles, do repairing, etc. Capital, $10,000. Incorporators, Earl S. Ross, Arthur F. Ells, Gustav A. Becker, all of Waterbury.

The Berkshire Street Railway Company, recently acquired by the New York, New Haven and Hartford railroad, will raise its capital $4,900,000 for the purpose of making extensions, additional equipment, power houses, car houses, etc.

MIDDLE STATES

The Home Stove Works, of Chicago, Ill., lost six of its foundries by fire.

A garage will be built by V. E. Phelps, at 10911 Clifton road, Cleveland, Ohio.

Foos Engine Company, of Springfield, Ohio, will erect a large addition to its plant.

The Mavers Motor Car Company, Port Huron, Mich., is extending its floor space.

P. S. Florea will build an automobile garage at 2134 Central avenue, Indianapolis, Ind.

A garage will be built by E. D. Wright, 739 East Ninety-Third street, at Cleveland, Ohio.

The Morris Machine Works, Baldwinsville, N. Y., will erect an addition to its erecting shop.

The J. P. Macbeth Iron Company, Cleveland, Ohio, is building an addition to its shops.

S. D. Wise, Cleveland, Ohio, will erect a concrete garage. H. O. Davison is consulting engineer.

The Cleveland (Ohio) branch of the Lozier Automobile Company will enlarge garage and equipment.

The shops of the Buffalo & Susquehanna railroad at Austin, Penn., were destroyed by flood and fire.

The shops of the Great Western Mining Company, of Crystal Falls, Mich., were destroyed by fire.

A machine shop is to be built for Hubbard & Co., at Sixty-Third and Butler streets, Pittsburg, Penn.

The Whitesides Commercial Auto Truck Company, of Franklin, Ind., is looking for another location.

The Ross & Young Machine Company, Detroit, Mich., has let contracts for a new shop on Center street.

The Luitweiler Pumping Engine Company, Rochester, N. Y., has completed plans for a two-story addition.

J. W. Smith, Cleveland, Ohio, will soon build and equip one of the largest commercial garages in the city.

The National Iron Foundry and Supply Company, of Williamsport, Penn., has purchased site at Oneida.

A large garage will be erected by Daviess, Stahl & Co., at Cleveland, Ohio. A. Garfield is the architect in charge.

The Belding-Hall Company, Belding, Mich., manufacturing refrigerators, is building an addition to its machine shop.

A new commercial garage will be built by Edward H. Jungclas at Reading road and Armstrong avenue, Cincinnati, Ohio.

The Baltimore & Ohio Railroad will soon be in the market for tool equipment for the shops to be built at Hardman, W. Va.

The Flanders Manufacturing Company, manufacturer of motor cars, will build an extension to its foundry at Pontiac, Mich.

Kraenter & Co., 571-585 Eighteenth avenue, Newark, N. J., manufacturing mechanics' tools, will erect a new four-story factory.

A permit has been issued to William Metcalf, Jr. to build a garage at 5821 Wilkins avenue, Fourteenth ward, Pittsburg, Penn.

The Wilson Dress Hook Manufacturing Company, Cleveland, Ohio, has raised its capital from $50,000 to $100,000 to add to equipment.

The Columbia Casting Company, a new concern, has purchased a factory site on Summit avenue near St. Luke hospital, Detroit, Mich.

The Bridgeton & Millville Traction Company will erect new car barns on Cohansey street, Bridgeton, N. J., adjoining power house.

A permit has been issued for a new garage for Hart, Seiler & Brother, Fifth street and Lycoming avenue, Philadelphia, Penn., to cost $1200.

The plant of the Chicago (Ill.) Soldering Machine Company, Fulton and Morgan streets, was partly burned. Loss, $3000. Will be rebuilt.

The Industrial Works, Bay City, Mich., is negotiating for site on which a new machine shop will be erected. About $200,000 will be expended.

Foote Brothers Gear and Machine Company has commenced a two-story factory at 219-21 North Curtis street, Chicago, Ill., and will install new tools.

The factories of William Vogel & Brothers, sheet-metal specialties, and E. Baggot Company, plumbing supplies, at 19-21 East Lake street, Chicago, Ill., were burned.

The American Ship Windlass Company, Providence, R. I., will move to Philadelphia, Penn. The concern manufactures the Taylor automatic stokers and ship machinery.

The Lozier Motor Sales Company, of Cleveland, Ohio, has moved into its new quarters and is erecting a two-story building, and will do a general garage and repair business.

Harbeck Motors Company, Chicago, Ill., has been incorporated with $50,000 capital to conduct foundry, do manufacturing, etc., by A. T. Erwin, R. S. Hartman, Charles Beenon.

Everhold Garter Clasp Company, Chicago, Ill., has been organized with $2500 capital to make clasps and other articles by Richard S. Folsom, Wallace Streeter, W. W. Dearmond.

Richardson - Neighbors Motor Company, Cleveland, Ohio, has been incorporated to do a sales agency and garage business by F. E. Richardson, H. F. Neighbors, W. J. Dawley, etc.

The M. D. Moore Manufacturing Company, Wayeland, Ind., has been organized with $2000 capital to manufacture can openers, by M. D. Moore, J. W. Robertson, J. R. Sharp, etc.

The National Shear and Tool Company, Jersey City, N. J., has been incorporated to manufacture tools by Geo. H. Powell, Melvin G. Palliser, Douglas V. Green. Capital, $300,000.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids October 31, for two engine lathes for the Mare Island Navy Yard as per Schedule No. 3947.

It is reported the New York Central lines are negotiating for the purchase of the site of the Youngstown (Ohio) Car Manufacturing Company for the erection of a large car-repair shop.

The Canton Castings Company, of Canton, Ohio, contemplates the erection of a plant at Kenton, Ohio. The company has been chartered to manufacture radiators and castings for school desks.

The Hammond Steel Barrel Company, Hammond, Ind., has been incorporated with $100,000 capital. Will erect a $50,000 plant on the Calumet river. J. H. Lafane, of Napoleon, Ohio, is president.

The International Metal Ceiling Company, Brooklyn, N. Y., has been incorporated with $25,000 capital to manufacture metal ceilings, etc. Incorporators, S. Kaplan, I. B. Kaplan, F. Bookstaver.

The Baker Taxicab Company, Dayton, Ohio, has been incorporated with $10,000 capital to operate a sales agency, garage, etc., by George L. Baker, Frank R. Baker, Harry W. Baker, Charles D. Heald, etc.

Acme Fireless Cooker Company, Quincy, Ill., has been organized with $15,000 capital to manufacture iron and sheet-metal products, by Sidney P. Sanderaft, Joseph W. Wall, H. M. Sheer, Harry A. Snow.

Air Line Manufacturing Company, Lancaster, Ohio, has been incorporated with $5000 capital to manufacture shears, razors and hardware, by Frank E. Wilson, George W. Moss, W. E. Shradach, etc.

The Pollak Steel Company, Cincinati, Ohio, successor to the Block-Polak Iron Company, manufacturer of car axles and heavy steel forgings, will make extensive improvements at its plant in Carthage, Ohio.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids October 24, for one lathe and one pipe-threading machine for the Iona Island Navy Yard as per Schedule No. 3982.

The Struthers Furnace Company, Cleveland, Ohio, has increased its capital from $300,000 to $1,000,000. Will rebuild furnaces and buy some new machinery for ore handling. W. S. Runyon is president of the company.

The Tri-City Motor Company, Albany, N. Y., has been organized with $5000 capital to manufacture automobiles and auto trucks. Directors are Rutherford B. Hayes, H. F. Andrews, Arthur S. Andrews, all of Albany.

Eberling Cement Tile Machine Company, Cleveland, Ohio, has been organized with a capital of $10,000 to manufacture machinery for the manufacture of clay products by C. M. Eberling, R. E. Davis, C. G. Blearsdale, etc.

Electric Signal and Engineering Company, Alliance, Ohio, has been organized with $20,000 capital to manufacture electrical signals and electrical and mechanical devices, by D. C. Schultz, Richard Jones, F. T. Cope, etc.

Several of the buildings of the new Delaware & Hudson railroad shops at Colonie, N. Y., are nearing completion, and it is expected that the plant covering 180 acres and employing 3000 men will be in full operation in about nine months.

The Osgood Motor Car Company, Brooklyn, N. Y., has been incorporated to manufacture and deal in motor vehicles and supplies. Capital, $10,000. Incorporators, S. H. Miskind, 178 Hewes street, Brooklyn; P. W. Smith, 174 West Eighty-Second street; I. J. Joseph, 1421 Madison avenue, New York.

SOUTHERN STATES

The Louis Bromm estate, Richmond, Va., will erect two garages.

The Louisville & Nashville railroad is erecting car-repair shops at Etowah, Tenn.

The Chickasaw Motor Car Company, Memphis, Tenn., recently incorporated, has secured a building and will conduct repair shop.

The Wm. J. Oliver Manufacturing Company, Knoxville, Tenn., contemplates installing malleable iron foundry and enlarging plow factory.

The Virginia Metal Products Corporation, Roanoke, Va., has been incorporated to manufacture culverts, etc. Capital, $150,000. J. B. Botts, president.

The Humason Rail Joint Company, Shreveport, La., has been incorporated to manufacture patented rail joints. Capital, $200,000. J. C. Willis, president.

Wm. C. O'Brien, 1314 Edmondson avenue, Baltimore, Md., has acquired a five-story building and will equip same for the manufacture of electrical appliances.

The E. C. Walker Manufacturing Company, Louisville, Ky., making gasolene engines, contemplates organizing another company for the purpose of building gasolene motor trucks.

WEST OF THE MISSISSIPPI

James S. Watson, Prosser, Wash., will build a new machine shop.

Mason & Butler, of Radcliffe, Iowa, will erect a 56x80 machine shop.

The New Prague (Minn.) Foundry Company will erect a new plant.

Victor Etienne, San Francisco, Cal., is having plans prepared for a new machine shop.

C. B. Webb, Portland, Ore., will build a new commercial garage and repair plant on Rodney avenue.

The Gulfport & Mississippi Coast Traction Company will erect a machine shop at Gulfport, Miss.

The Star Foundry Company, Seattle, Wash., will build a new foundry plant at Youngstown, near Seattle.

The Gronning Motor Company, of Holloway, Minn., is planning to move its plant to Rochester, Minn.

The blacksmith plant of the McCrumb & Clark Company, Midvale, Ida., was destroyed by fire. The plant will be rebuilt.

The Parker Iron Works, San Bernardino, Cal., has had plans prepared for an addition to its plant to be used for forge and pipe shops.

The Maryland Garage Company, Pasadena, Cal., plans for the erection of a new commercial garage and repair plant on East Colorado street.

The Northwest Auto Company, Bellingham, Wash., will establish a new commercial garage and repair plant. Modern machinery will be installed.

Van Sant & Brown, Poplar Bluff, Mo., conducting general repair and contract shop, are erecting a new building. Will be equipped with modern tools.

F. P. Fay and J. G. Grant, Los Angeles, Cal., are having plans prepared for a commercial garage and repair plant to be erected on Ninth street.

The Pacific & Eastern railroad has commenced work on temporary machine shops on East Main street, Medford, Ore. Will later build permanent shops.

The Copper River & Northwestern railroad, Cordova, Alaska, will build new machine shop and car shops at Cordova. F. C. Gorman will be in charge.

Mayor Rushlight, Portland, Ore., has recommended to the city council the purchase of a portable blacksmith shop for the fire, street-cleaning and other departments.

Huron Rock, Santa Barbara, Cal., agent for the Cadillac car, will establish a new commercial garage and repair plant on State street. Modern equipment will be installed.

The Santa Fe railroad is beginning preliminary work on the proposed additions and improvements to its repair shops at Richmond, Cal. About $25,000 will be expended upon this work.

The Pearring-Smith Auto Company, San Diego, Cal., recently organized, has leased quarters on C street, and will establish a commercial garage and repair plant to handle the Abbott-Detroit car.

The Santa Fe railroad has appropriated $156,000 for the erection of its roundhouse and repair shops at Riverbank, Cal., a new terminal. A similar sum is to be allowed for the erection of a like plant at Calwa, Cal.

CANADA

The Clinton Motor Truck Company will equip a big new plant at Clinton, Ont.

W. E. Reynolds, of Buffalo, N. Y., will equip a brass-manufacturing plant at Bridgeburg, Ont.

The North Vancouver Steel Car Company will locate a big new plant at North Vancouver, B. C.

The Michigan Central Railway will build a big new roundhouse and shops at St. Thomas, Ont.

The Automatic Gas Producing Machine Company will locate a large new factory at Vancouver, B. C.

The A. E. White Machine Company, of Eau Claire, Wis., will build a big branch factory at Windsor, Ont.

The Singer Sewing Machine Company, of New York, will equip a small branch factory at Bridgeburg, Ont.

The Imperial Wire and Cable Company will equip a large new plant at Montreal. Rennie C. McMurty, president.

The Des Marais Machine and Drill Company will locate a new factory at Ottawa. George R. Nash, manager.

The Airozone Electric Ventilating Company will locate a plant for manufacturing electrical apparatus at Toronto. Gideon Grant, president.

FOREIGN

Holman Brothers, Camborne, Cornwall, England, manufacturers of rock drills and mining machinery, are enlarging their rock-drill department and are in the market for machine tools suitable for their purpose.

Union Cerrajera, Mondragon, Spain, manufacturing locksmiths' supplies and hardware, wishes to install additional American machine tools and is in the market for machines for making locks, hinges, keys, etc. Also foundry equipment, including hydraulic presses, cupolas, blowers, molding machines, cranes, etc.

General Manufacturing

NEW ENGLAND

Warren, Mass., contemplates the installation of a water system.

The Warner Cotton Mills, Newburyport, Mass., are to enlarge equipment of plant.

The Merrick Lumber Company, Holyoke, Mass., will build an addition to its plant.

Oliver M. Dean, Worcester, Mass., is to expend $10,000 for a new broom factory in that city.

Westfield, Mass., has issued $24,000 bonds for improvements to its gas and electric-light plant.

Fire damaged the plant of the Malden (Mass.) Grain Company to the extent of about $10,000.

The Franklin Felt Mills, Franklin, Mass., is shut down and extensive alterations will be made.

The cooperage shop of the Merrimac Chemical Works, North Woburn, Mass., was burned. Loss, $15,000.

Sutton, Mass., contemplates the installation of a pumping plant and electric motor for running same.

The sawmill of the Emerson Lumber Company, Bangor, Me., was destroyed by fire. Loss, $20,000.

Oscar R. Boehne & Co. are establishing a gold- and silver-refining plant at 57 Broadway, Providence, R. I.

Plans are being drawn for the Beacon mills, of New Bedford, Mass., that will increase the present plant one-half.

The Worcester Electric Light Company, Worcester, Mass., contemplates extensive additions to its power plant.

The Hall Piano Company, Boston, Mass., recently incorporated, contemplates erecting a factory at East Douglas, Mass.

The Metropolitan Carriage Company, Bridgeport, Conn., has let contract for a two-story factory building on Grand street.

The J. & P. Coats Thread Company, at Central Falls, R. I., is beginning the erection of an addition to its power plant.

Fire destroyed the grist mill of Ireland Brothers, Corrina, Me., including equipment for town lights, located in the mill.

The Peerless Celluloid Company, Northboro, Mass., has purchased a plant in that town and will equip for manufacturing purposes.

The Strathmore Paper Company, Springfield, Mass., intends to install new heating machinery in addition now being erected.

The Greylock Mills, North Adams, Mass., will install a new engine of larger capacity to replace the one in use at the present time.

The Auto Repair and Salvage Company, East Hartford, Conn., is building an addition to its garage to be used for a boiler room and heating plant.

The plant of E. R. Whitman Company, Charlestown, Mass., manufacturer of store fixtures and refrigerators, was badly damaged by fire. Loss, $7000.

Contract has been let for three new buildings to be erected by the J. F. Meehan Granite Works, at the corner of Clark and Union streets, New Britain, Conn.

The Charles E. Austin Company has been incorporated with a capital of $10,000 at Providence, R. I., and will locate a plant there for the manufacture of boxes, bags, etc.

The Hartford Packing Box Company, Inc., Hartford, Conn., has incorporated with $25,000 capital to manufacture wooden shipping cases. Incorporators are Enos O. Springer, Henry W. Seide and Solomon Elsner.

The Franklin Process Company, recently incorporated for $300,000 is equipping a factory for dyeing and bleaching purposes and to manufacture machinery at Promenade street, Providence, R. I. J. C. Helden is vice-president.

A new power station, for which $60,000 is available for construction and $120,000 for the equipment of the building, is to be erected at the naval torpedo station at Newport, R. I. Ground will be broken for the structure on April 1.

The Chapinville Satinet Mill, Chapinville, Mass., which has been idle for several years, has been bought by a syndicate of woolen-goods men of Boston, and the new owners announce that the plant will be refitted and reopened at an early date.

The Frary Automobile Lighting Company, Springfield, Mass., will move its plant to Holyoke, Mass., where it has leased part of the plant of the Holyoke Warp Company's plant. It manufactures a special lighting system for automobiles and contemplates enlarging in the near future.

MIDDLE STATES

The village of Navarre, Ohio, will construct a water-supply system.

The Cleveland (Ohio) Hydrogen Ice Company is erecting a new ice plant.

Frank Caveny will install a boiler at 519 South East street, Indianapolis, Ind.

The Hupp Motor Corporation, of Detroit, Mich., is erecting a new power plant.

The *Cleveland* (Ohio) *Press* building will soon require power and other equipment.

The Faultless Rubber Company, Ashland, Ohio, is erecting an addition to its plant.

Edmunds & Jones, of Detroit, Mich., manufacturers of auto lamps, are erecting a new factory.

New Castle, Penn., is contemplating erecting a municipal electric-light plant to cost $200,000.

The Mohawk Silk Fibre Company, of Fultonville, N. Y., is starting a plant at Schenectady, N. Y.

The Trumbull Public Service Company, Warren, Ohio, will make improvements to its power plant.

Friedman & Scanlon will soon start the erection of an ice-manufacturing plant at Alliance, Ohio.

The Lillibridge Lumber Company will build a new mill at Grand river and Avery avenues, Detroit, Mich.

The T. B. Townsend Brick and Contracting Company, of Zanesville, Ohio, is preparing to enlarge its plant.

The Wabash Pottery Company, Roseville, Ohio, has increased its capital and will add equipment to its plant.

The Washington Lumber Company, Washington, D. C., will erect lumber mills of 100,000 feet daily capacity.

The Indianapolis (Ind.) Brush and Broom Company will erect a new factory building at Brush and Market streets.

The Manitowoc (Wis.) Clay Company's plant, owned by Elmer Leach, Oshkosh, Wis., will be enlarged this fall.

A new factory will be built by the Superior Cigar Manufacturing Company at Hendrie and Chene streets, Detroit, Mich.

The town of Elmore, Ohio, Ottawa county, has issued bonds for the construction of a municipal waterworks system.

The Pingree Shoe Manufacturing Company, of Detroit, Mich., will soon move into its new factory and will need equipment.

The Arctic Ice Cream Company, of Detroit, Mich., has just completed its new plant and more equipment will be needed.

Alexander Hesch, of Detroit, Mich., manufacturer of artificial limbs, is erecting a new factory and will need equipment.

The Sycamore Grain and Milling Company, Sycamore, Ohio, will put up a new elevator. T. E. Underwood is interested.

The Clifton Springs Distillery, of Cincinnati, will soon erect an $18,000 dry house, which will need special equipment.

The Wheat Ice Cream Company, Buffalo, N. Y., has secured a permit to erect a $112,000 factory at 217-231 Elm street.

The Townsend Brick and Contracting Company, Zanesville, Ohio, will make improvements to its plant to cost $50,000.

Improvements will be made to the Zanesville, Ohio, municipal waterworks plant. E. E. Everett is director of public service.

Plans are being prepared for a large plant for the American Articial Silk Company, at Camden, N. J., power house included.

A new dynamo will be purchased by the village of River Rouge, Mich. (near Detroit), for its municipal light and power plant.

The factory of the Canneiton (Ind.) Chair Company was partly destroyed by fire. The plant is controlled by A. P. Fenn, of Tell City, Ind.

Merck & Co., Rahway, N. J., will increase the capacity of their power plant. Will install two new boilers and refrigeration system.

The Bryce Brothers Glass Company, Mount Pleasant, Penn., has let contract for the construction of a two-story building to cost $200,000.

The Spring Valley Mining Company, of Zimmerman, Mich., near Iron River, is erecting an engine and boiler house and other additions to its plant.

A boiler will be installed at the new plant of the United States Bank Furniture Company, at Sixteenth and Lewis streets, Indianapolis, Ind.

Plans have been filed for a textile factory for James Bromley, at Leiper and Deal streets, Frankford, Philadelphia, Penn., to cost $100,000.

George Brush and associates, Roseville, Ohio, have bought the plant of the Zanesville Tile Company and will equip it for the manufacture of pottery.

The Churchill Furniture Company will build a large factory at 1770 to 1808 North Hoyne avenue, Chicago, Ill., and equip it through with new machinery.

The Hunter Brush Manufacturing Company, Columbus, Ohio, has raised its capital to $150,000 and will make improvements to its equipment for brush making.

The Armitage Avenue Cabinet Manufacturing Company has commenced a one-story factory at 2220-38 North Springfield avenue, Chicago, Ill., and will install new machinery.

The board of fire commissioners of Seneca Falls, N. Y., is considering the rearrangement of the village fire-alarm system and the installation of an independent power plant.

Coshocton Telephone Company, Coshocton, Ohio, has been organized with $150,000 capital to build and operate a telephone exchange by W. S. Crater, P. Jensen, C. C. Fohl, etc.

The Millersburg glass plant of Millersburg, Ohio, has been sold to S. B. Fair, who will organize a new company and resume operations. Numerous improvements are contemplated.

The Wolf Manufacturing Company, Quincy, Ill., has been organized with $10,000 capital to manufacture and deal in saddlery goods. Incorporators, Fred Wolf, F. A. Wolf, L. F. Wolf, etc.

The New London Water Company, New London, Ohio, has been organized to build and operate a waterworks system for New London by G. M. Cummings, W. L. David, John M. Garfield, etc.

The New Madison Lighting Company, of New Madison, Ohio, has been incorporated and will erect a plant to furnish electric light and power in New Madison and vicinity. J. A. Flaig, principal stockholder.

The Maxwell Manufacturing Company, Cleveland, Ohio, has been incorporated to manufacture office appliances by Fred A. Maxwell, William M. Guthrie, Jacob L. Van Dame, etc. Capital, $10,000.

The Hetzell-Gelatine Products Company, of Germany, will build a branch factory in Cincinnati, Ohio. Geo. W. Losh, president of the First National bank, of Madisonville, Ohio, is interested in the new project.

The Oak Hill Street Railway Company, Chicago, Ill., has been incorporated to construct and operate street and interurban railways. Capital, $20,000. Incorporators, Chas. Pullman, I. A. Isaacson, L. S. Watts.

The plant of the Diamond Flint Glass Company, Vincennes, Ind., which was recently destroyed by fire, with a loss of $30,000, will be rebuilt at once. The company manufactured glass bottles and employed 200 persons.

Sycamore Grain and Milling Company, Sycamore, Ohio, has been incorporated with $75,000 capital to build and operate flouring mills and to do a grain business. Incorporators, F. E. Underwood, M. L. Underwood, L. E. Chamberlin, etc.

The International Automobile League Tire and Rubber Company, capitalized at $100,00, has secured site at Northland avenue and Chelsea place, Buffalo, N. Y., and will erect a $60,000 plant for the manufacture of pneumatic tire and inner tubes.

Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 3 p.m., October 25, for one gas engine and electric generator, etc., for the United States Post Office at London, Ky. Specifications can be had of the Supervising Architect.

The Taylor Heat and Light Company, of Columbiana, Ohio, has been incorporated with a capital of $30,000 to erect an electric and gas plant at Taylor, Williamson county, Texas. The incorporators are W. A. Chambers, C. L. Lehman, D. N. Garver, John V. Chambers and Fred D. Lodge.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids October 31, for auger bits, steel bolts and nuts, twist drills, steel figures and letters, portable forges, hinges, wood screws, steel cap screws, machine screws, steel tapes, gasolene torches, wrenches as per schedule 3978.

SOUTHERN STATES

B. W. Chapman, Alamo, Tenn., will install an electric-light plant.

Scottsburg, Ky., is considering the construction of waterworks.

Oriental, N. C., will install an electric-light plant. W. B. Ward, clerk.

Jackson, Ga., will issue $12,000 bonds for improving its electric-light and water plants.

Harlingen, Tex., voted to issue $22,000 bonds for waterworks and electric-light plant.

The Central Fertilizer Company, Midville, Ga., will erect a phosphate-acid plant to cost about $155,000.

The Schwartzschild & Sulzberger Company, of New York, will establish a cold-storage plant at El Paso, Texas.

The Texas Land and Lumber Company, Houston, Texas, will build several large sawmills to develop property recently acquired.

The Wheeling Mold and Foundry Company, Wheeling, W. Va., contemplates increasing its capital $500,000 and will install a power plant.

E. J. Adams, Waycross, Ga., is at the head of a company which will construct an ice plant of 100 tons daily capacity to cost about $75,000.

The Atlantic Ice and Coal Corporation, of Albany, Ga., will build a new ice-making plant at Augusta, also at Inman yards, Atlanta. Will install additional equipment in plants at Albany and Fort Valley and improve central plant at Atlanta.

WEST OF THE MISSISSIPPI

Boonville, Mo., voted $10,000 bonds for waterworks.

S. M. Brann will put up a grist mill at Miles City, Mont.

The Holdredge (Neb.) Creamery Company will erect a plant.

Deep River, Iowa, voted to issue bonds for installing an electric-light plant.

The Gwyther (N. D.) Creamery Company has secured a site for a creamery.

The city of Everett, Wash., plans for the erection of a garbage-incinerator plant.

The Cold Spring Brewing Company, at Litchfield, Minn., will erect an addition.

The Farmers Coöperative Creamery at Thief River Falls, Minn., will be enlarged.

The lumber plant of the Union Lumber Company, Reno, Nev., was destroyed by fire.

The Alpha mine, near Phœnix, Ariz., is planning to install new hoisting machinery.

The Ocosta (Wash.) Whaling Station is contemplating the erection of a cold-storage plant.

The city of Venice, Cal., is planning for the installation of a municipal waterworks system.

The Wolif River Chair Company, of New London, Iowa, will build an addition to its factory.

The Forest City (Iowa) Company Operative Creamery Association will erect a modern creamery.

S. L. Cross and S. C. Johnson, Spray, Ore., will install new pumping machinery for a water system.

The city of Salmon City, Ida., contemplates extensions in its waterworks system to cost about $30,000.

The Comstock mines, Virginia City, Nev., plan for the installation of new centrifugal pumping machinery.

The plant of the Calpenham Lumber Company, at Kapowsin, Wash., was destroyed by fire. Loss, $50,000.

The Pacific Fruit and Produce Company, Seattle, Wash., plans for the erection of a cold-storage addition to its plant.

W. H. Caldwell, John Casey and Roy G. Staples will erect a shoe factory on North Main street, Stillwater, Minn.

Engelber Wiese, Howkan, Alaska, operating a fish-curing plant, plans for the erection of a cold-storage and freezing plant.

Woodworking and other machinery will be required by J. W. Fletcher, who will build a large furniture factory in Oroville, Cal.

The Tire Service Company, Spring street, Los Angeles, Cal., has taken out a permit to build a new boiler-room addition to its plant.

The Northern California Power Company, Sacramento, Cal., is planning to extend its power system to Arbuckle and Grimes, Cal.

The Suburban Homes Company, Los Angeles, Cal., plans to install new pumping plants on property in the San Fernando valley.

The Pacific Coast Refrigerating Company, North Powder, Ore., will build a new ice and refrigerating plant. About $35,000 will be expended.

The city of Walla Walla, Wash., contemplates the erection of a municipal electric power plant. Mr. Cropp, mayor of the city, is interested.

The Washington Steel and Iron Company, Spokane, Wash., is planning for the erection of a smelting plant for iron ores, near Blewett, Wash.

The Lakeview Oil Company, Bakersfield, Cal., operating the Lakeview Gusher, will install new pumping machinery to force a flow at its wells.

Miller & Lux, Inc., San Francisco, Cal., have taken out a permit to erect a modern carriage-painting plant. The plant will be fully equipped.

The hop-drying plant and machinery of Hedges & Doris, Independence, Ore., was completely destroyed by fire. The loss is estimated at $15,000.

The Gregory Mill Company, Rainier, Wash., has commenced the erection of a large lumber mill plant. The plant will be complete and fuly equipped.

James Ballantyne, Santee, Cal., has broken ground for a new electric power plant, near El Cajon, Cal. The plant will be modern and fully equipped.

Samuel Samson, Stevenson, Wash., operating a hydroelectric power plant, plans for the construction of a power-transmission system to Hood River, Ore.

The Helena (Ark.) Gas and Electric Company has let contract for the construction of a new light and power plant. Will also erect modern water plant.

Frank Cole, Mountain House, Cal., operating a sawmill plant, is planning to remove to a new site and will make improvements in his present plant.

The Pacific Portland Cement Company, Vacaville, Cal., is planning to build an electric power system in this district. A franchise has been granted.

The Weber Showcase and Fixture Company, Los Angeles, Cal. (wood specialties), has taken out a permit to make alterations and additions in its plant.

The St. Gothard Consolidated Gold Mining Company, Nevada City, Cal., will install a complete water system for the operation of its mining properties.

The Perkins Press, Tacoma, Wash., will increase the capacity of its printing plant and install new machinery. S. A. Perkins is head of this company.

The Saginaw Orchard and Timber Company, Cottage Grove, Ore., has commenced the erection of a sawmill plant. The plant will be fully equipped.

The Board of Education, Riverside, Cal., has authorized the city clerk to advertise for bids for woodworking machinery for the manual-training department.

The Gridley (Cal.) Produce and Canning Company is planning for the installation of an electric-light and power plant for plant operation and for lighting.

The Randolph Fruit Company, Porterville, Cal., has taken out a permit to build an addition to its fruit-packing plant. Modern equipment will be installed.

The Sacramento Valley Power Company, San Francisco, Cal., contemplates the extension of its power system from Cottonwood into the Dry Creek district.

The Mt. Diablo Telephone Company, Martinez, Cal., has been incorporated to install a telephone plant and system in this district. H. C. Wetmore is president.

The Trinity Dredging Company, Weaverville, Cal., is planning to install an electric power system in the vicinity of Lewiston, Cal. A franchise has been granted.

In connection with the new municipal dock to be erected by the city of Tacoma, Wash., a large cold-storage plant will be established. The city engineer is in charge.

Charles I. D. Looff, Long Beach, Cal., is planning for the erection of a plant for the manufacture of merry-go-rounds. The plant will be large and fully equipped.

The Tri-State Telephone Company, Socorro, N. M., plans to install a plant and system at Las Cruces, N. M. A franchise has been granted. D. D. Clark is in charge.

The Frank Graves Sash, Door and Mill Company, Los Angeles, Cal., has taken out a permit to build an addition to its lumber-working plant on North Avenue 19.

The planing mill of Sullivan & Larsen, Rio Vista, Cal., was destroyed by fire, with a loss of about $10,000. The plant will be rebuilt and new machinery installed.

The Home Telephone Company, Grants Pass, Ore., plans to install a plant and system over this entire section of Josephine county. A franchise has been asked.

The city of Leavenworth, Wash., is planning to install a municipal waterworks plant. City Engineer Green has prepared plans. A bond issue will be voted for this work.

The Southern California Edison Company, Los Angeles, Cal., has acquired a site at Riverside, Cal., and is said to be planning for the erection of a new electric substation.

The city of Folsom, Cal., contemplates the extension and improvement of its waterworks system. Dr. George T. Hesser is head of the committee appointed for this work.

O. P. Brown, Seattle, Wash., formerly manager of the Pacific Coast & Norway Packing Company, contemplates the erection of a salmon-canning plant in southeastern Alaska.

The fruit-packing plant of the Alhambra (Cal.) Orange Growers' Association was destroyed by fire. Loss, about $17,000. The plant will be rebuilt and new machinery installed.

The Pacific Gas and Electric Company, San Francisco, Cal., is planning for the establishment of a gas-manufacturing plant near Livermore, Cal., with a system to supply this district.

Gorman & Co., Seattle, Wash., fish canners and packers, have acquired a codfish-packing plant at Anacortes, Wash. The plant will be rembodeled and made into a modern fish cannery.

The plant of the Mount Vernon (Wash.) Oil Company has been acquired by the Standard Oil Company. The new owners will make improvements and additions to cost about $10,000.

The W. H. Eccles Company, Ogden, Utah, is planning for the erection of a new lumber plant near Baker, Ore. The plant will comprise planing mill, finishing mill and box manufactory.

The Henry McCleary Timber Company, McCleary, near Montesano, Wash., has commenced the erection of a new door-manufacturing plant. The plant will be fully equipped.

A refrigerating plant will be installed in the new hotel to be erected at Beverly Hills, near Los Angeles, Cal., by the Rodeo Land and Water Company. Elmer Grey, Los Angeles, is architect.

The Reclamation Service, Elephant Butte, N. M., is preparing plans for a coal-handling plant to include mechanical stokers for the power plant to be erected in connection with the Elephant Butte dam.

The American Battery Company, Seattle, Wash., recently incorporated, will establish a plant for the manufacture of electric batteries, near Los Angeles, Cal. T. A. Stewart is interested in this company.

The Newerf Company, Los Angeles, Cal., will soon select a site for the establishment of a large plant for the manufacture of automobile tires and rubber specialties. W. D. Newerf is head of this company.

The Abbott Kinney Company, Venice, Cal., plans for the erection of an electric-light and power plant near the Venice power house. About $100,000 will be expended. Abbott Kinney is head of this company.

An electric-lighting and power plant will be installed in the new 12-story addition to be erected to the Oregon hotel, Portland, Ore. About $500,000 will be expended on this extension. Doyle, Patterson & Beach, architects, Portland.

The Arizona Power Company, Prescott, Ariz., is planning to install a power system from Poland Junction to Crown King, Ariz., in the Bradshaw mountain mining district. R. S. Masson, Los Angeles, Cal., is chief electrical engineer.

The Colonial Wall Board and Plaster Company, Oakland, Cal., is planning for the erection of a plant for the manufacture of its specialties. James A. Yarrington is president of this company, which is said to be a subsidiary of the Pittsburg (Penn.) Plate Glass Company.

The Pacific Light and Power Company, Los Angeles, Cal., now engaged in preliminary work for its proposed hydroelectric power plant on Big Creek, near Fresno, Cal., is planning an extensive power-distributing system in connection, throughout Fresno county. A franchise has been asked. G. O. Newman is engineer on this work.

The California Glass Insulator Company, Los Angeles, Cal., has acquired property at Long Beach, and is having plans prepared for an extensive manufacturing plant. The plant will include melting building, molding plant and machine shops, and will be fully equipped. Jules Kauffman is president and Robert P. Frist, general manager, of this company.

CANADA

Galt, Ont., will extend its waterworks plant.

Guelph, Ont., will extend its electric-lighting plant.

I. B. Renaud & Co. will equip a cold-storage plant at Quebec City.

Davidson, Sask., will equip a complete new electric-lighting system.

Steelton, Ont., will equip a complete new electric-lighting system.

The Merchants Rubber Company, of Berlin, Ont., will double its plant.

Berlin, Ont., will spend $20,000 on new electric-lighting machinery.

Calgary, Alberta, will call for tenders for sewer-trenching machinery.

The Scarfe Varnish Company, of Brantford, is extending its plant.

Neepawa, Man., will spend $100,000 equipping a complete new waterworks system.

Calgary, Alberta, will expend $400,000 on waterworks extensions and new machinery.

The Muskoka Wood Manufacturing Company, of Huntsville, Ont., will double its plant.

The Dryden Timber and Power Company will equip a pulp and power plant at Dryden, Ontario.

The Canadian Bakery Company, of Winnipeg, Man., Can., will erect a three-story modern plant.

Montreal will build a low-level pumping station and install a 12,000,000-gallon steam pumping plant.

The Bazan Bay Pressed Brick and Tile Company will equip a large new plant at Turgoose, B. C.

The Crescent Creamery Company will equip a $250,000 plant at Winnipeg, Man., with the latest machinery.

The National Hydro Electric Company will equip a big power-development plant at Carillon Falls, Que.

The Free Press Printing Company will expend $300,000 on a new building and equipment at Winnipeg.

Saskatoon, Sask., will spend $2,500,000 developing power for street railway, lighting and manufacturing.

The Barcelona Traction, Light and Power Company, of Toronto, will equip plants to develop power in various parts of the province.

Lethbridge, Alberta, is calling for tenders up to November 24, of a complete steam turbo-generator set, with condensing equipment, steam engine driven exciter and all accessories.

The Frenchs Complex Ore Reduction Company will erect three big factories at Nelson, B. C., one for treating zinc ore, one for making dry batteries and a third for making zinc pigment.

MINING

The Boston & Corbin Copper Company, Corbin, Mont., plans for the erection of a concentrating plant.

The Perseverance Mining Company, Juneau, Alaska, plans for the erection of a large stamp mill early in 1912.

The Ostrich mine, near Arivaca, Ariz., will install a new cyanide plant. M. E. Ish is interested in this property.

The White Cloud mine, near Denny, Cal., plans for the erection of a stamp mill. Brown & Williams operate this property.

The Pacific Coal Mines, Ltd., Victoria, B. C., will install a complete coal-mining plant at its property in the Suquash district.

The Treasure Gold Mining Company, Hornitos, Cal., plans to increase the capacity of its stamp mill from 5 to 10 stamps.

The Monarch mine, Elk City district, Ida., plans to increase the capacity of its stamp mill. New machinery will be installed.

Jesse Knight, Provo, Utah, operating mining property in the Duchesne district, contemplates the erection of a new stamp mill.

The McKinley Mining Company, Orient, Wash., plans for the erection of a 100-ton milling plant and cyanide plant early in 1912.

The Lucy Gray mine, Sunset district, near Desert, Cal., contemplates the erection of a cyanide plant. John Bright is superintendent.

The International mine, operated by the Pearson Company, Pearson, Chihuahua, Mex., will increase the capacity of its stamp mill and cyanide plant.

The Mesa Rica Gold Mining Company, Moctezuma district, Sonora, Mex., will install new concentrating equipment. W. I. Cayzer is general manager.

The French Complex Ore Reduction Company, Ltd., Nelson, B. C., contemplates the erection of a reduction plant for zinc ores. A. G. French is interested.

The Mt. Royal Mining and Reduction Company, Phillipsburg, Mont., has commenced the erection of a new stamp mill. The plant will be modern, and fully equipped.

The Atlixtac Mining Company, Taxco district, Guerrero district, Mex., plans to increase the capacity of its stamp mill and install new concentrating machinery.

The North Star Mines Company, operating the Champion mines, Nevada City, Cal., contemplates extensive improvements in its stamp mill. New machinery will be installed.

The Tonque Coal and Oil Company, Albuquerque, N. M., recently incorporated, plans for the installation of a plant for coal-mining operation, near Algodones. John J. Duffy is head of this company.

Business Items

The Standard Welding Company, Cleveland, Ohio, has opened a sales office in Chicago, Peoples Gas building. B. A. Quayle and A. C. Clark in charge.

The F. B. Shuster Company, New Haven, Conn., advises that an erroneous report is abroad, owing to the death of F. B. Shuster last August. It states that the company is being continued on the same lines and under practically the same management. It has a large amount of business on hand, the shop running full time with a full force.

Trade Catalogs

The Abbott-Ball Company, Hartford, Conn. Pamphlet. The Abbott burnishing process by means of steel balls. Illustrated, 20 pages, 3½x6½ inches.

Diamond Tool and Die Company, 308 Pearl street, Hartford, Conn. Catalog. Diamond tools, diamond dies. Illustrated, 14 pages, 3½x6 inches.

Norwalk Brass Company, Norwalk, Conn. Catalog. Brass and bronze engine fittings, special castings, etc. Illustrated, 48 pages, 3½x9 inches.

IngersollRand Company, 11 Broadway, New York. Pamphlet No. 3007. Class PB duplex power-driven air compressors. Illustrated, 24 pages, 6x9 inches.

The Green Fuel Economizer Company, Mattewan, N. Y. Catalog No. 137. Heating and ventilating. Illustrated, 94 pages, 6x9 inches.

Forthcoming Meetings

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Sachs' standardized tool requisitions; mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery built to order; modern plant; 30 miles from New York. Box 335, Amer. Machinist.

Wanted work in light stamped sheet-metal specialties. Bernardin Bottle Cap Company, Evansville, Ind.

Will buy or pay royalty for a good patented machine, tool, or attachment, Box 1372, New Haven, Conn.

Wanted—Screw machine work; send blueprints or samples for quotations. Remington Mfg. Co., Fitchburg, Mass.

Wanted—Second-hand planer, 72 inches by 12 feet; must be in first class condition. Address W. S. Milne, Cleveland, Tenn.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Special machinery designed and built to order; tools, jigs, fixtures, sheet metal tools and stampings. Frank J. Dyett Co., Ilion, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for inventor's Handbook.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Expert designing of difficult work; original work or redesigning special machinery and devices; high-class work only. Henry R. Evans, 3 West 29th Street, New York.

Have you a small machine work business; punch and die, screw and drill press work? Do you want to sell same? If so, write at once to E. E. Wadsworth, 234 Congress St., Boston.

Joseph V. Woodworth, mechanical expert, will estimate and advise on sheet metal formation, and die, tool, model and light manufacturing work, 165 Broadway, New York, Room 1611.

Wanted—Address of J. H. Emerson, who worked for Wheeling Mold and Foundry Company during 1910. It will be to his benefit to correspond with this firm. Address Box 158, Wheeling, W. Va.

For Rent—Good town, central New York, new factory, completely equipped with power and large and small tools for metal and wood work; 6400 feet floor space; free lights. Box 439, American Machinist.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

Have you something of merit you desire to manufacture or are manufacturing and want help; young manager with proven selling ability and some capital would like to hear from you; must be honest. "Eastern Salesmanager," American Machinist.

Technical patents are best taken care of by an engineering patent attorney, with sound practical experience, both as an engineer and as an attorney; highest references. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraph Company, Baltimore, Md.

Die and press tools from the simplest to most intricate designed and constructed by experts; will make dies to produce parts and articles of sheet metal at minimum cost; will manufacture parts from the tools if this is desired. Address Die and Press Department, The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

Following second-hand machines in good condition and with reasonable prices are wanted: one lathe, 16 inches by 9 feet; one lathe, 8 inches by 3 feet; one drill press, medium, and one high speed; one shaper, 24 inches; one planer, 24x24 inches by 5 feet; one universal milling machine. Address "Maxaadian, 45 Fuller St., Schenectady, N. Y.

Valuable manufacturing property, about 200 miles from New York City, consisting of machine shop, foundry, pattern shop, smith shop, power house, pattern storage, sheds, etc., suitable for manufacturing pumps, compressors, engines, tools or other machinery; equipment modern and in A-1 condition; railroad sidings into buildings; ten-ton traveling cranes; good shipping point, three railroad systems; fine labor and material market; an established business on a line of high grade machinery could go with plant, if desired, the manufacture of which would utilize a part of its capacity or might consolidate with other business or contract to manufacture other machinery. Box 294, AMER. MACH.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—A first class spring shop foreman, one having had experience in railroad elliptic and coil springs. Box 393, AMER. MACH.

CONNECTICUT

High-class shop foreman wanted, with experience in most uptodate manufacturing methods in medium-sized machines; we are looking for a man not more than 40 years old, energetic, ambitious and knows how to handle men; a man with experience in manufacturing small engines, small refrigerating machines, or cream separators, preferred; lasting position for the right man. Send application, with references and salary expected to "K. T.," AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—A skilful and experienced man to act as foreman on erection of high speed, high grade, heavy machinery. Write, stating age, experience and salary expected. Box 421, AMERICAN MACHINIST.

MISSOURI

Wanted—Superintendent who can invest $2000 to $3000; five-year contract. Suite 616 Commerce Bldg., Kansas City, Mo.

Wanted—Traveling salesman, mechanically inclined, in West and Southwest, vicinity Chicago and St. Louis, to sell foundries, forge shops, etc., in connection with his present other lines of manufacture in above field; state reference, experience, etc. Box 417, AMERICAN MACHINIST.

NEW YORK

Wanted—First class designing engineer on adding machine work; to receive attention, state age, experience and salary expected. Box 432, AMERICAN MACHINIST.

Wanted—By large manufacturing concern in Pennsylvania, horizontal boring mill, to be paid for in exchange for foundry, machine or boiler-shop work. Address Box 434, AMERICAN MACHINIST.

Wanted—Tool steel salesmen for all States to sell a leading brand of high-speed and carbon steels; write, giving particulars, age, salary expected, experience, territory covered, to Box 259, AMERICAN MACHINIST.

Machinist, young man as assistant to superintendent in Brooklyn factory; must be experienced in use of machinists' tools and in making repairs; $15 to begin. Address by letter only, stating particulars or no notice taken. R. F. Wire Co., 160-162 Wooster St., New York City.

Wanted—Speed boss in large automobile factory; one who is competent to set premium and speed work prices on sheet metal work, wood work, and gas engine parts; do not apply unless you have held similar position and can make good. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Tool Designers—Experts on punches and dies; only those top notchers capable of earning big money need apply; a first-class proposition for the right kind of man; work in New York City; write, stating age, nationality, experience and salary expected. Address "Designers," care Allen Agency, 45 West 34th Street, New York City.

OHIO

Wanted—First-class machinists on floor and vise work; no labor troubles; steady employment. Box 387, AMERICAN MACHINIST.

Wanted—Draftsman, experienced designer, rotary valve motion for compressors and Corliss valve gear of steam engines; state age, shop experience, reference and salary wanted. Box 373, AMERICAN MACHINIST.

Wanted—Foreman of testing department; must be familiar with practically all types of 4-cycle internal combustion engines; must be aggressive and have good executive ability. Box 418, AMERICAN MACHINIST.

Wanted—By large manufacturing concern in specialty line, a young man, technical graduate preferred, one who is thorough and accurate and who could work into a position as checker in drafting room; permanent position and good salary; previous experience in same line not essential. Box 424, AMER. MACH.

Wanted—A superintendent by company manufacturing high-grade steel specialties; must be mechanically and electrically educated and thoroughly experienced in modern factory methods; an unusual opportunity for the right man; give full particulars as to age, education and experience. Box 394, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 399, AMERICAN MACHINIST.

Wanted—Competent shop superintendent for large steam-engine manufacture; desire someone well acquainted with best modern shop practice and bonus system. Box 403, AMERICAN MACHINIST.

Wanted—Superintendent for sheet metal ware factory, employing 150 hands, located in Middle West; one who is thoroughly competent to take charge of drawing, stamping and spinning sheet metal goods and who can design and lay out the necessary dies, chucks, templates, etc., for this work. Apply, giving age, experience, salary expected and references to "S," AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—Master mechanic capable of handling repair department of finishing works; must be first-class executive, good disciplinarian and able to turn out the work at minimum cost; only thoroughly equipped and experienced man need apply; state fully your qualifications, experience, age and salary desired. Box 360, AMER. MACH.

TENNESSEE

Wanted—First-class foreman capable of taking charge of men in jobbing shop and small manufacturing plant; give reference and salary wanted; only man perfecty familiar with jobbing business considered and one who has had experience as foreman. Atlas Machine Co., Nashville, Tenn.

WASHINGTON

Wanted—General foreman for a plant manufacturing a line of knife switches, switchboards, panel boards, steel cabinets and electrical specialties, in a Pacific Coast city; must be thoroughly familiar with uptodate methods of manufacture in this line, having a knowledge of tool making and designing, and be a good organizer and executive; plant employs at present about 45 hands; salary for first year $175 per month; no transportation expenses allowed; applicants must state age, give brief outline of experience and inclose copies of references; do not answer unless sure you can properly fill the position. Box 396, AMERICAN MACHINIST.

WISCONSIN

Wanted—Man of about thirty-five to take charge of machine department, about sixty men, shops near Chicago. Box 420, AM. MA.

Wanted—Draftsman familiar with designing centrifugal pumps and other hydraulic machinery; location, Middle West. Box 419, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Superintendent or general foreman; good organizer and uptodate in factory efficiency; United States or Canada. Box 365, AMERICAN MACHINIST.

ILLINOIS

Tool designer of long experience on punch and die work, wants position; competent for chief draftsman or assistant superintendent. Box 409, AMERICAN MACHINIST.

General foreman or foreman; 18 years' practical experience on medium and heavy work; used to piece work and modern methods; prefer Middle West. Box 423, AM. MA.

IOWA

Will be open for engagement next week as drop forge superintendent; can manage all departments. Box 416, AMER. MACHINIST.

MASSACHUSETTS

First class designer on automatic machinery, jigs, fixtures, dies, etc, a thorough mechanic, wishes position. Box 438, AM. MACH.

NEW JERSEY

Machine shop superintendent or shop manager, good executive, organizer and systematizer, now employed, desires change. Box 422, AMERICAN MACHINIST.

Superintendent wishes to make a change, accustomed to fine and medium heavy interchangeable work; a designer of modern tools, jigs, and special machinery for rapid production. Box 383, AMERICAN MACHINIST.

Mechanical engineer and designer desires responsible position; two and one-half years' drafting room, 10 years' shop experience (six executive); uptodate on modern manufacturing methods on both large and small work; age 31; highest references. Address "Capable," Care AMERICAN MACHINIST.

NEW YORK

Superintendent would consider a change. Box 362, AMERICAN MACHINIST.

An efficiency engineer, will be open for an engagement after first of October. Address "Beecher," 303 Sumner Ave., Brooklyn, N. Y.

Superintendent, 20 years' practical and uptodate experience, exceptional mechanical ability, thoroughly familiar with modern cost reducing systems. Box 440, AM. MACH.

Mechanical engineer, expert mechanic, 15 years' experience in designing and operating large machine shop, foundry and erection, desires responsible position. Box 433, AM. MA.

Mechanical engineer, thoroughly familiar with design, construction and testing of valveless, two-cycle, crude-oil engines, European pattern, iampless after starting, desires position. Box 405, AMERICAN MACHINIST.

Superintendent, high-grade executive, can meet competition in highly competitive lines, never failed to surpass all expectations in making good my representations, contracting companies in foundry machinery, tools and die work would interest me. Address "Mechanical Engineer," Box 437, AMER. MACH.

OHIO

Designer, experienced in dies, tools and automatic machinery, wants position. Box 220, AMERICAN MACHINIST.

Shop superintendent-engineer, exceptional mechanical and executive talent. Box 425, AMERICAN MACHINIST.

PENNSYLVANIA

Man, several years in charge of general machinery and furnace design, desires situation as chief draftsman or designer. Box 436, AMERICAN MACHINIST.

Superintendent, engines and electrical apparatus, capable manager of shop and foundry, good cost reducer and thoroughly versed in modern manufacturing, desires change; Middle West preferred. Box 428, AM. MACH.

Wanted—Position as manager or salesman by young man, with technical education; has held both of above positions in machine tool manufacturing concern, and at present is employed in former capacity; position in or near Philadelphia preferred. Box 426, AM. MACH.

VIRGINIA

Mechanical engineer, draftsman, designer; college education, with wide and various experience on general engineering, desires good position. Box 415, AMERICAN MACHINIST.

FOR SALE

Heating apparatus to be sold cheap; two Hopson & Chapin boilers about 3500 feet radiation; two H. B. Smith boilers about 4300 feet radiation; all in good condition; 500 radiators, also pipe and fittings; call and see us. Seagrist, 308 Avenue B, New York City.

Owner of a modern plant in Middle States manufacturing staple, uptodate light mechanical apparatus, well known in the trade, and protected by patents, would sell half or whole interest to party who could devote whole time to the business; this is a side development of owner which now takes too much time from his main business and is the only reason for selling; this is a first-class opportunity for a successful mechanical shop and sales manager, should not care to consider less than $8000 to $10,000 interest; only principals will be considered. Box 427, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

Read what this man (name on request) says about the paying ideas in the Selling Section:

When a standard machine of any kind is needed, such as a lathe, a drill press or a boring mill, and the purchaser has not already made up his mind just what type will be best suited to his purpose, his first impulse is to turn to the advertising columns of the paper where the largest number of tools of the kind are represented. Then, by making comparisons, he gradually sifts the list down to three or four machines that particularly appeal to him, upon which he proceeds to secure prices. Prior to this, he or his superintendent or foreman, have probably been keeping track of the latest developments in design, by turning over the advertising pages from week to week, and impressions have been created that make the final narrowing down of choice a comparatively rapid process. The need felt for new tools is also quickened. This is probably the most common use of the display sections of the paper and the one most generally recognized as desirable.

It is, however, a safe gamble that the average shop manager does not realize how many of his best ideas, including those received from the foremen or machinists, originated in suggestions obtained from glancing through or studying advertisements with no definite purpose in view. Frequently the seed of such an idea is sown, it lies dormant in the mind and suddenly under the stimulus of the right conditions, it shoots up into the consciousness.

To illustrate. The assistant superintendent of a large harvester company looking over the pages of the AMERICAN MACHINIST, was interested by the announcement of a new pressure pump for use with hydraulic systems. As a triplex, compound machine, resembling others of its class, there seemed to be nothing of special interest in its construction, except that it had an automatic release from the low pressure cylinders. At the time, however, he thought nothing more about it and continued to turn the leaves until he had come to the end.

Weeks afterwards, consideration was being given to a problem arising in the assembling department, where the number of breakages in pressing shafts on the frames of the large machines, had, under the stress of rush orders, assumed serious proportions. The difficulty was due to the fact that some of the shafts went on very tight, and the heavy forcing pressure, with no counter influence or relief, simply meant the giving away of the metal. While talking over the matter, there suddenly flashed into the assistant superintendent's mind the advertisement of the pump. With the use of one of these on the press, when a tight shaft or a tight place on the shaft was encountered, the low pressure cylinders would be automatically thrown out, by the rising pressure, and the load thrown on the high pressure cylinders of lower diameter, thus immediately reducing the speed of the operation and gradually finishing it without dangerous strain. This plan had a trial and the result proved very satisfactory, breakages from tight fits practically ceasing.

In another plant, which ordinarily worked only day shifts, a large order taken on the basis of prompt delivery compelled night operation for a portion of the works, including the finishing department. The amount of power required did not justify running the electric generating sets in the engine room, so, as in similar instances before, current for running the motors on the tools, cranes, etc., was taken from its mains, thus enabling the dynamos to be shut down. It seemed, however, necessary to keep up steam, in order to operate the big Corliss air-compressor, as the use of certain pneumatic tools could not be dispensed with, and this meant considerable extra expense.

One of the day foremen, who had been temporarily put on the night work, was thinking of this condition and wondering if there were not some means of avoiding it, when he recalled seeing, some weeks before, the advertisement of a portable motor-driven compressor, which could be taken about a plant, as needed, and plugged in wherever there were electrical connections. Why wouldn't one, or several of these, if necessary, do for their night service? The matter of putting a motor-driven compressor in the engine room had been up before, but was vetoed on account of the initial cost. Here, however, seemed to be something relatively inexpensive which would probably serve the purpose even better by eliminating transmission losses. For night service it could be taken to the department where it was needed and shifted as required. The next morning, before retiring, he hunted through his file of papers until he found the advertisement, and that afternoon he got to the shops early in order to have a talk with the superintendent. The latter at once approved the idea and it was put through.

Today the use of such portable sets is a commonplace, but at the time of which I write it was a novelty, and the shop men who discovered it early were that much ahead of the other fellows.

Is it not this readiness to find and seize upon improved machinery or methods of any kind that keeps one manufacturer in advance of another? The successful politician has his ear to the ground, the successful salesman knows what customers are thinking about, and the successful manager is constantly on the watch for ideas. How can he find them better than in the place where they are brought to market?

One young fellow, whom I knew very well, made his reputation with the firm and has since risen to a position of great responsibility with one of the leading railroad companies by studying the advertisements of shop machinery and auxiliary appliances. For the latter he often went far afield, into papers that the rest of us never thought of reading; now it is no longer necessary to diffuse one's energies to that extent, as one journal covers practically everything of interest to the up-to-date manager, superintendent or foreman. But it illustrates how much importance he attached to such information. Whenever a new subject came up, this fellow was right on hand with a variety of information that astonished his superiors, and he seemed to feel instinctively what it would be most useful to bring out. In time everyone got to depending upon him; he was regarded as a walking encyclopedia. Of course, as I learned afterwards, he looked up his subjects pretty thoroughly when he got the first ideas. Others have followed the same plain road to success.

* * *

Only reliable products can be continuously advertised.

Shop Methods That Cut Costs

By Fred H. Colvin*

The handicap of an old shop has been largely counteracted by the adoption of almost innumerable kinks which save time in handling material and in doing the work after it has been put in place on the machines. These include methods which ought to find a wider field of usefulness.

*Managing editor.

The Chicago & Northwestern railroad shop at Chicago, Ill., has more kinks and helpful devices than almost any shop I have ever visited, which reflects credit on the inventiveness of the men and also on the ability of the management to draw out their ideas to such an extent as shown. These devices, and the spirit behind them, are largely responsible for the splendid record made by these shops.

When an engine is stripped and before any of the parts go to the shop to be handled, they are loaded onto the pans made of boiler plate and handled by the air hoist crane shown in Figs. 1 and 2, being lowered into the tank of boiling lye to have all the dirt and grease boiled off before they go into the shop. In this way all the parts for the same locomotive are kept together and they go back into the machine shop in the same way; hence there is no time lost in sorting out material for the different locomotives. This matter of cleaning costs very little and saves not only time but a large amount of disagreeable work.

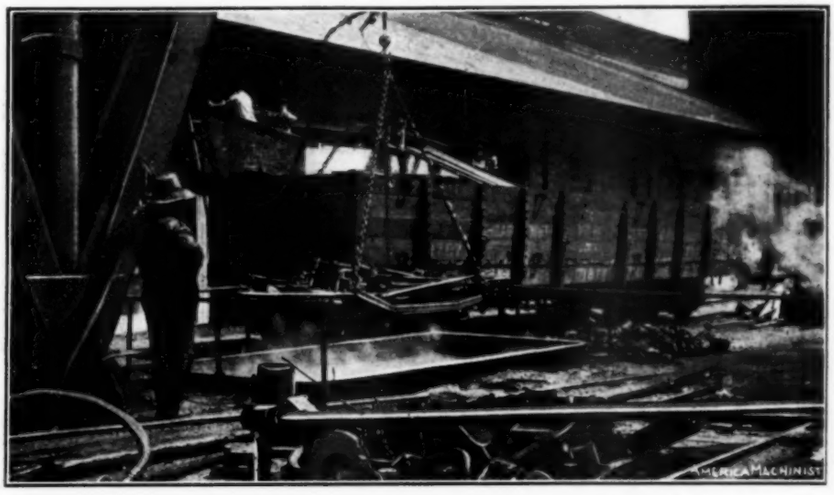


FIG. 1. WASHING GREASY PARTS IN LYE TANKS BEFORE REPAIRING THEM

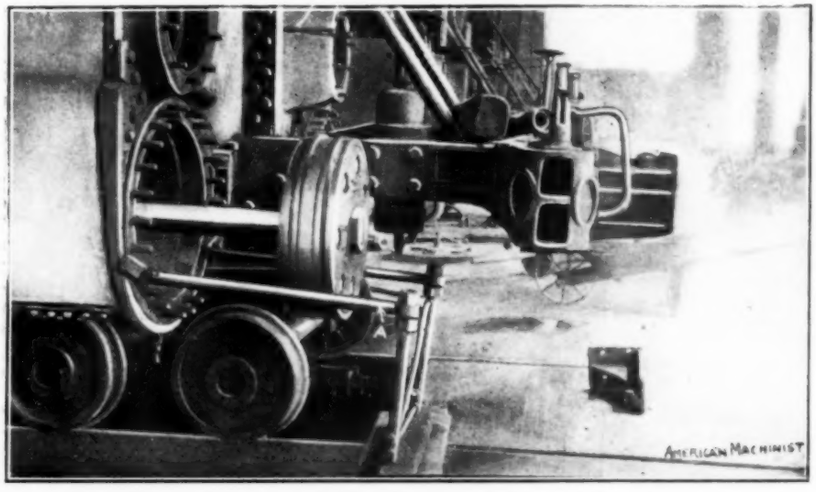


FIG. 3. PISTON-HANDLING FRAME

PISTON HEAD HANDLING FRAME

A little device for placing pistons in cylinders, which saves considerable lifting and packing, is shown in Fig. 3. The arms *A* are simply round iron having flat ends for fastening over one of the cylinder head studs, while the other end carries the upright which has been made the correct length for use in the majority of cases. In the particular instance shown these were too short and are blocked up by pieces of timber. It is the intention, however, to have these uprights adjustable, so that they can be readily fixed for any locomotive without the use of blocking.

The small cranes shift up the piston heads and rods and place them on the supports in the position shown. It is then an easy matter to push the piston head into the counterbore of the cylinder, as the piston head is firmly supported at the correct position, which saves considerable time in getting the locomotives ready for the roads.

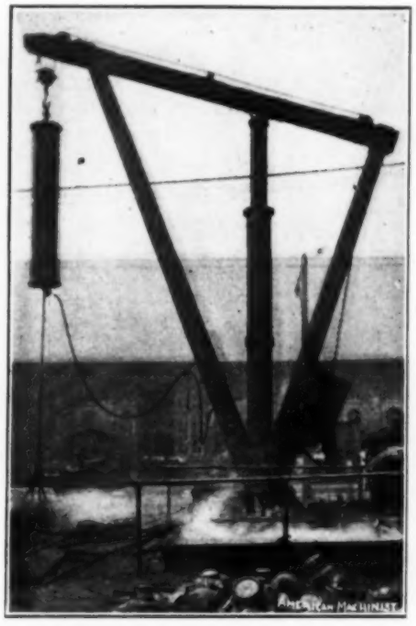


FIG. 2. THE LYE TANK AND FRAME

CONVENIENT CRANES

The economical handling of material has received very careful attention in these shops, and it is quite probable that the cost is less than in many shops equipped with modern cranes.

Fig. 4 shows a type of crane that is very convenient and is used in the rod department as can be seen. Overhead is a pair of rails, perhaps 3 feet apart, carrying a small truck having a square plate on the under side. Pivoted in the center of this is the crane arm, with a wheel at the back or short end and carry-

FIG. 4. AIR HOIST ON CIRCULAR CRANE

ing a small trolley at the other, this trolley supporting a direct air hoist.

This, it will be seen, gives a wide range of handling capacity, the air hoist being readily moved to any part of the crane arm, can be swung through the entire circle and the whole thing moved the entire length of the shop on the overhead track.

In addition to this, the outer wall of this same bay is liberally supplied with jib cranes having air hoists. These jib cranes lap over the area covered by the smaller cranes, as can be seen in Fig. 5 and make it possible to handle work quickly and easily to any part of the department.

It will also be noted that this department is equipped with Cooper-Hewitt vapor lamps, placed above the cranes, and giving very good distribution.

TURNING PISTON RINGS

Piston-ring making may be divided into two general methods—the casting of a "pot" and cutting it up into rings after turning inside and out, and the individual-ring method. The Chicago & Northwestern railroad used the latter method.

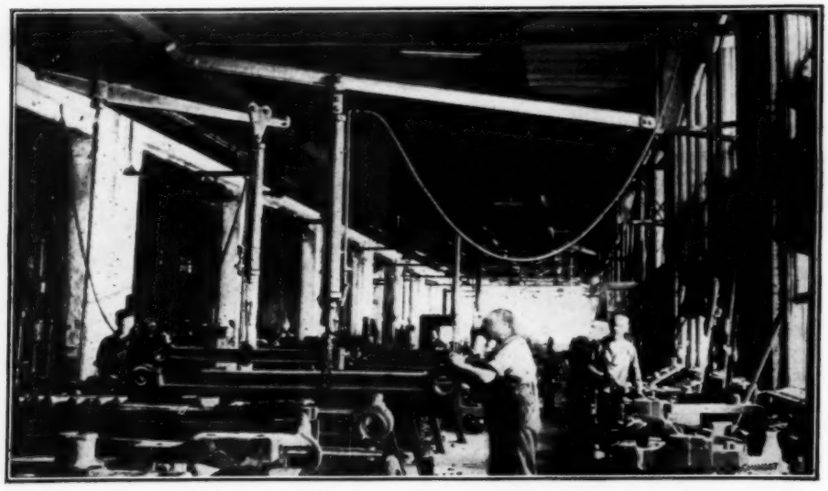


FIG. 5. HANDLING APPARATUS IN THE ROD DEPARTMENT

The rings are cast separately, are not bored or finished on the inside at all—leaving the skin of the metal to add strength and give spring and stiffness.

They are then mounted on an expanding chuck or mandrel as shown in Fig. 6 and finished on the outside and the sides at one setting.

The mandrel consists of a split ring, which goes inside the ring and is narrow enough to let the side tools pass by in facing the sides of the ring. This split ring is set out by the eight jaws or spokes, which are worked by a cone inside the hub, acting on their inner ends by means of the hexagon shown. Gang tools in a turret tool post, make the machining easy and the cost of making the rings is lower than might be imagined.

MAGNETIC CHUCK FOR AIR-PUMP RINGS

As air-pump piston packing rings are rather light to hold in the ordinary chuck, the magnetic chuck shown in Fig. 7 has been made for this purpose.

The four jaws are simply adjusted to center the ring and the magnets hold it in place. The pilot lamp on the bracket, which is fastened to the lathe carrier, shows when current is on, and the fuse block is also very handy in case renewals are necessary.

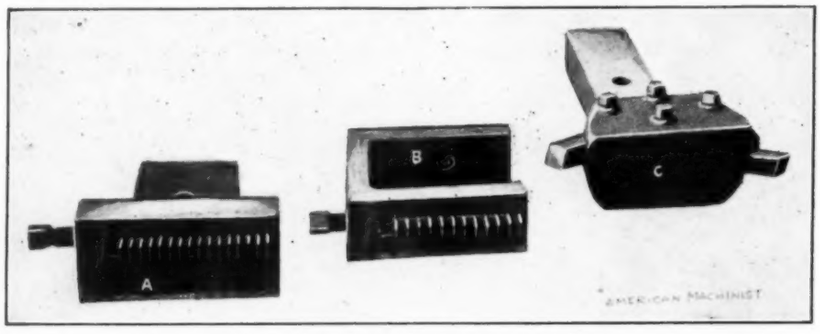


FIG. 8. AIR PUMP PISTON-RING TOOLS

GANG PISTON-RING TOOLS

The tools shown in Fig. 8 are used in cutting up piston rings for air pumps, and need little description. Two styles of cutting-off tools, *A* and *B*, are used, being

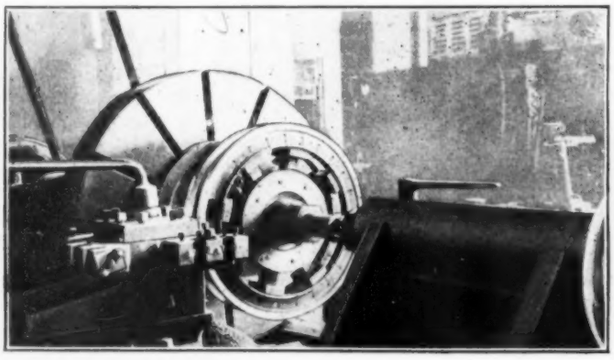


FIG. 6. EXPANDING MANDREL FOR TURNING PISTON RINGS

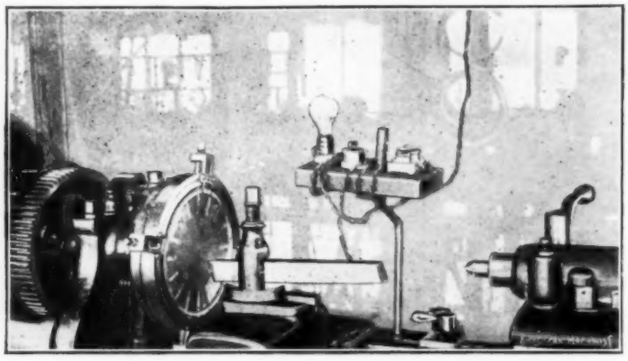


FIG. 7. MAGNETIC CHUCK FOR PISTON RINGS

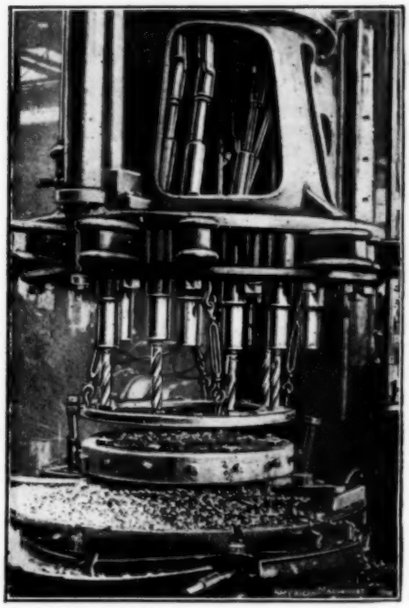


FIG. 9. LIFTING A DRILL JIG AUTOMATICALLY

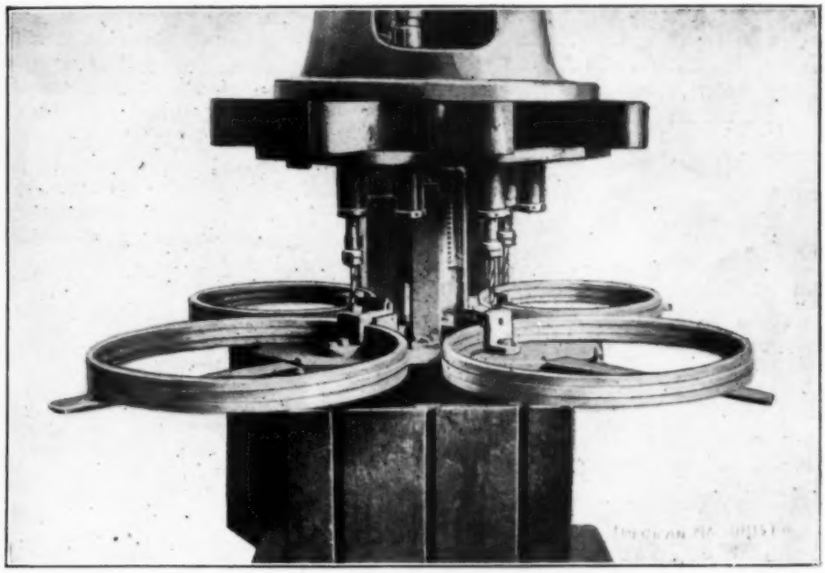


FIG. 13. DRILLING MANY PISTON RINGS

held in different ways but having similar cutting tools.

The other tool *C* is a boring head or tool for boring the pot from which these rings are made.

AUTOMATIC DRILL-JIG LIFTER

Fig. 9 shows a multiple driller used for drilling the ends of several separate pieces at one setting. These pieces are held in the ring shown and can be handled very quickly.

The method of handling the drilling jig, which guides the drill to the work, is interesting. By simply tapping four holes in the jig plate at convenient points and four similar holes in the head of the driller, it is an easy matter to screw in hooks and connect them by turnbuckles, as can be seen.

Then, after the holes are drilled, the head is run up out of the way by power and lifts the jig with it. When the fixture is loaded again, the head is run down, the jig clamped in position, and the driller spindles start to work once more. This saves a lot of time and also muscular effort on the part of the operator.

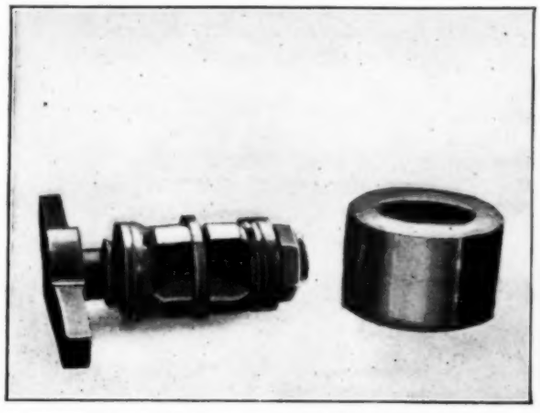


FIG. 10. ROD-BUSHING MANDREL

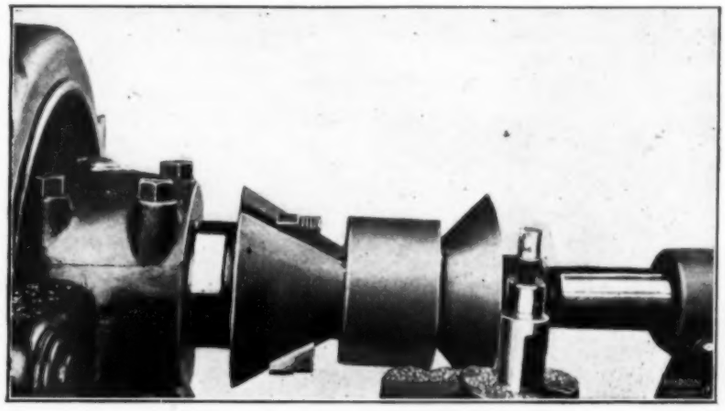


FIG. 11. ANOTHER MANDREL

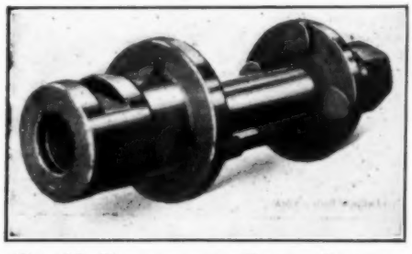


FIG. 12. MANDREL FOR CROWN BRASSES

A HANDY EXPANDING MANDREL

An expanding mandrel, used for turning rod bushings, is shown in Fig. 10, and has several points in its favor.

It is very substantially made to handle heavy work, is easily adjusted and has nothing to get out of order.

It consists of a mandrel carrying a cone at one end, next to the plain portion for the dog, another cone working on the threaded end opposite, and four jaws with the ends tapered to fit these cones. Flat, shallow grooves are planed in each cone to receive the ends of the jaws and keep them from turning or crowding out of place. A light, flat spring fits around the center of the four jaws, resting in a turned depression, and holding the jaws in place on the mandrel, yet allowing them to be easily adjusted in either direction.

Screwing the end nut on or off the mandrel, increases or decreases the diameter of the outside of the jaws, and holds work very firmly from the inside. It also allows the ends to be faced off while on the mandrel.

Another mandrel, which has been developed along this line, is seen in Fig. 11. This screws onto the lathe-spindle nose, and the sliding, stepped jaws fit in the grooves at the left. The bushing is placed over the step of the nearest size, and when the cone at the right is forced on, it tightens the work so that it can be turned with a heavy cut.

CROWN-BRASS MANDREL

Crown brasses are not easy to hold, but the mandrel shown in Fig. 12 accomplishes the purpose satisfactorily. The mandrel screws on the nose of the spindle

and the flanges carry hardened-steel dogs having serrated surfaces. These dogs have square shanks and fit into corresponding holes, which prevent turning.

At the bottom is a strut, which is set

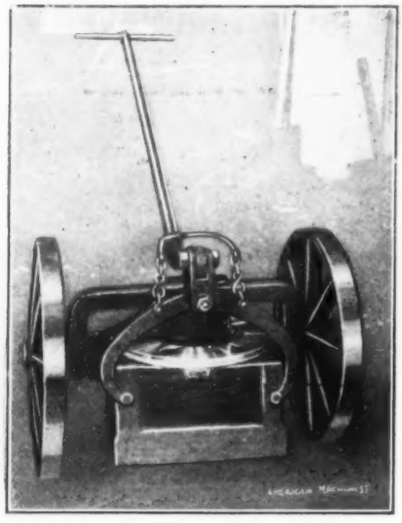


FIG. 14. HANDLING DRIVING BOX

to prevent the flanges being thrown out of alinement when in use.

DRILLING PISTON RINGS

Fig. 13 shows a drilling fixture for handling 12 piston rings at one setting to be drilled for the offset joint, which is used in this case.

Four extension arms of bar iron support the outer edge of the rings, while four angle brackets carry the drilling bushing. Inside of these are four jaws,

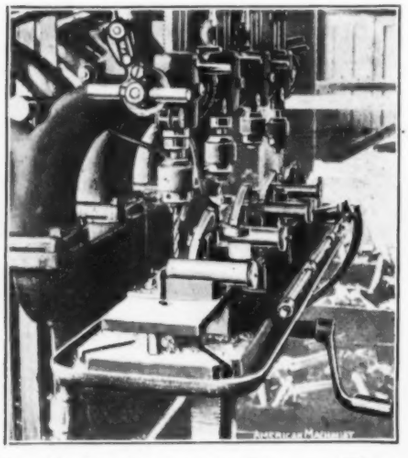


FIG. 15. AIR CLAMPS FOR DRILLING WORK

which are operated by a cone-shaped plunger in the center, controlled by an air cylinder, which forces the cone against the end of the jaws and clamps the rings between these jaws and the angle plates carrying the drill bushings. The whole operation is very simple, and when the fixture is set up under the multiple driller shown, it handles rings of any size very accurately and rapidly.

HANDLING DRIVING BOXES

One of these methods for handling material quickly and economically is shown in Fig. 14. It is a two-wheel chuck carrying a pair of jaws on the order of ice tongs, excepting that the ends which come under the driving-box flanges are round pieces parallel with the sides of the driving box. These jaws are operated by the handle, which can be seen on top of the regular handle for the chuck having a cross piece at the end. The chuck is simply wheeled over the driving box until the jaws will reach under the flanges, and they are then allowed to drop down into place by releasing the handle already referred to.

AIR CLAMPS FOR HOLDING WORK

Fig. 15 shows a four-spindle gang driller used for drilling cotter-pin holes in the ends of pins or studs. Under each spindle is a V-block to accommodate any sized pin that it may be necessary to drill, and each block is equipped with an air clamp, as can be seen by a close inspection of the illustration. These air clamps are operated by a simple plunger acting on the outer end of the clamp, and bringing the holding end down on top of the pin to be drilled, holding it firmly in place during the drilling operation.

The location of the hole in the pin is determined by the distance of the drill from the plate, which the pin rests against, and which runs in front of all four of the V-blocks.

Milling Fixture for Press Crank Shafts

Large numbers of punch presses are built by the Waterbury Farrel Foundry Company, Waterbury, Conn., and great care is exercised to make component parts of each size of press interchangeable.

Fig. 1 shows a punch-press crank shaft after the first turning, ready to mill the slot for the clutch pin.

Fig. 2 shows the fixture *K* used for this operation. The fixture *K* has a cylindrical

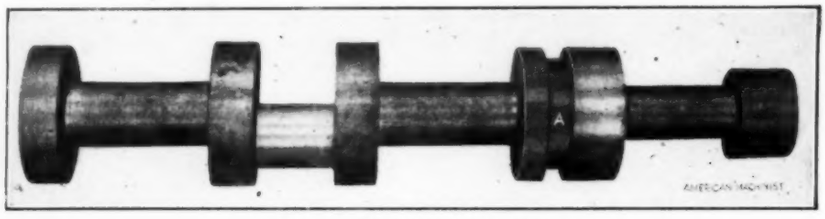


FIG. 1. THE CRANK SHAFT

tongue *B* which fits the groove *A*, Fig. 1, in the crank shaft.

At *C* in the tongue *B* a small radial hole will be noticed; this is used when setting the cutter *G* by means of the gage *E*. The pin *D* which fits in this hole *C* bears a certain relation to the slot *F* in *E*.

When the fixture *K* is secured to the miller table the gage *E* is set in it with the pin *D* in the hole *C*. The clamping jaw *H* is then screwed up, clamping the gage in place with the slot *F* perpendicular to the center of the fixture. The cutter *G* is now placed on the arbor and the cross slide moved till the cutter *G* is in line with the slot *F*. The gage *E* is then replaced by the crank shaft, which is set to correct position by means of the two centers *L* and a square.

But one fixture is used to hold the work. The one shown at the front in the halftone is merely to make the construction plain.

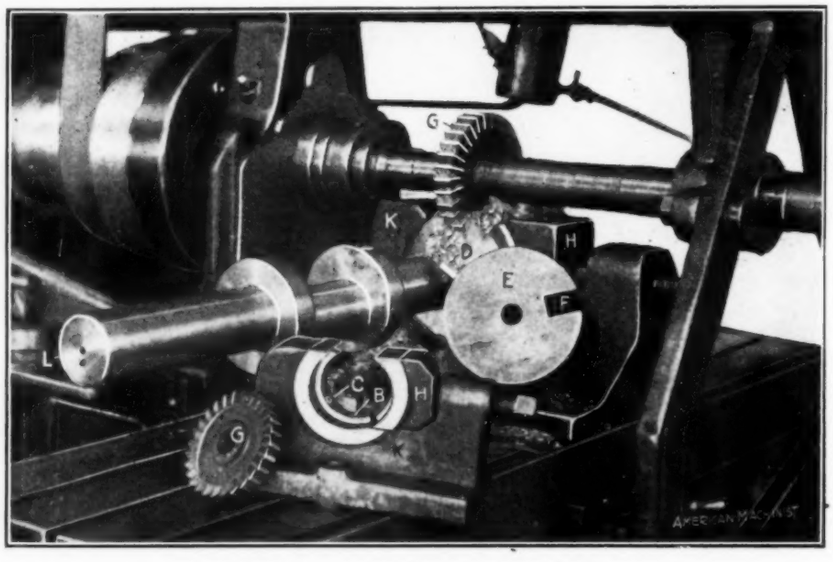


FIG. 2. FIXTURE FOR MILLING CRANK SHAFTS

Standardization of Machine Tools*

By L. P. Alford†

There are many features of machine tools that could be standardized for the benefit of the user. The six governing principles to follow in bringing about this desirable uniformity are:

Standardize corresponding designations and capacities, and establish a method of power rating.

Standardize devices for holding cutting tools.

Standardize devices for holding work and fixtures.

Standardize operating movements.

Standardize parts concerned in setting up machines with reference to the permanent shop equipment.

Accept the geometric progression as a fundamental requisite in designing feeds and speeds.

Standardization of product is a necessity in manufacturing. It is the starting point in every attempt to produce great quantities of parts cheaply and uniformly. The advantages are readily recognized. There are similar advantages in the standardization of processes and tools used in manufacturing, and this broad fact is the reason for this paper.

The problem of standardizing machine tools is very important. I propose to treat it in a manner to establish the principles that should be followed to obtain the desired uniformity in details, rather than to go very far into the details themselves, except by way of illustration.

I doubt if any one of you questions the proposition that much can be done along the line suggested by my title to the immediate advantage of the purchaser and user of the machines. At the same time nothing can be tolerated that will tend to hinder development; first, of the machines broadly, and, second, of a given machine as an individual.

Before beginning my argument with reference to mechanical details I must refer briefly to the nomenclature of machine tools and their parts. A committee of the association is considering the question of standardizing the names of machine tools. Permit me to say that I am in full sympathy with this movement and hope for a speedy report and action.

But is there not a wider field that this committee might consider than merely the generic names of the machines? Why not take up the names of individual parts? No argument is needed to convince you of the confusion that now exists. Take the common word "dog." There are probably as many varieties of inanimate dogs as there are species of canines shown on the benches of the average dog show.

*Address given before convention of National Machine Tool Builders' Association.
†Editor.

Swing			Spindle Details							
Swing Over Bed, Inches	Swing Over Carriage, Inches	Maximum Distance Between Centers	Diameter and Thread of Nose	Taper of Hole	Taper of Centers	Diameter of Hole in Spindle	Weight 6 Ft. Bed, Pounds	Threads per Inch of Lead Screw	Circumferential Speed of Pulleys in Feet per Minute	Size of Tool
	8½		2¼x6	Morse 4	M-2	1"	1715	6	285–362	¼x1"
14⅛	8⅜		2⅛x6		M 3	1⅛		4	645–785 950	¼x1"
15⅛	9½	3' 3"				1 1/16		8	395–525	
16	10½	3'	2¼x8			1⅛	1600	5	475	¼x1
15¼	10⅞		1⅞x8			¾		6	375	
15½	9⅜	3' 4"	2⅛x5		M 3	1 3/16	1650		350–475	⅜x1"
14½	7½	2' 11"	2⅛x7			1⅛	1550		585	
15½	8½	2' 6"	2⅜x7		M 3	1⅛	1825		380–485	¼x1"
14⅞	8⅞	3' 1"	2x7	¾ per foot	M 2	1 3/16	1600	6	375	¼x1
16¼		3'	2 1/16x6	⅝ per foot	M 3	1⅜	1850	6	525–660	⅜x1

TABLE I. COMPARISON OF CERTAIN DIMENSIONS OF TEN 14-INCH, 6-FOOT BED ENGINE LATHES

What is the distinction between a table and a platen? Between an arbor and a mandrel? Between a bed and a base? Between a pillar, a post and a column? What is a jig, a fixture? And so on.

The foreign user must not be forgotten. Whatever simplifies the descriptions of machines facilitates translation and comparison and is a direct aid to him in getting a mastery of the situation. In the interest of technical accuracy it is very much to be desired that a reasonable uniformity should be established in the names of machine parts.

Principles in the Standardization of Machine Tools

But turning to the machines, there are six important principles in standardization, which I have formulated as follows:

1. Standardize corresponding designations and capacities, and establish a method of power rating.
2. Standardize devices for holding cutting tools.
3. Standardize devices for holding work and fixtures.
4. Standardize operating movements.
5. Standardize parts concerned in the setting up of machines with reference to the permanent shop equipment.
6. Accept the geometric progression as a fundamental requisite in designing feeds and speeds.

The application of none of these principles will introduce a radical change in design, for, on the contrary, either through action by the association or through a process of natural development, uniform features can be pointed out substantiating the importance and setting a precedent for the application of each principle.

The First Principle

The first principle aims at a standardization of corresponding machine designations and capacities, and the establishing of a method of power rating. In 1903 action was taken by a number of miller manufacturers, establishing the maximum feed travels for various sizes of knee-and-column millers. For example, the maximum feed travels for a No. 2 universal machine were fixed as follows: Longitudinal, 25 inches; cross, 8 inches; vertical, 18 inches. This was a start toward standardizing designations and capacities. The resulting uniformity is of advantage to the buyer in comparing the various makes of machines designated as Nos. 1, 2, 3, 4, etc.

But this is only a beginning.

To develop the point, what is a 14-inch, 6-foot bed engine lathe? From data that have been prepared comparing some of the dimensions of a number of 14-inch,

6-foot bed engine lathes, it is found that the diametrical swing over the bed ranges from 14⅛ to 16⅛ inches; the swing over the plain carriage from 7½ to 10¾ inches and the maximum distance between centers from 1 foot, 6 inches, to 3 feet, 3 inches.

From the user's standpoint it is as important to know the diameter that can be swung and turned over the carriage as it is to know the maximum diameter that can be swung over the ways. And the length of the bed is of no more interest than the hight of the lathe hand that operates it. A similar argument can be presented for other kinds of machines, but would serve only to lengthen this discussion unnecessarily. Is there not an opportunity to bring about reasonable uniformity of corresponding designation and capacity, making these descriptive?

Turning to the question of power rating, the user should have some means of distinguishing between the relative capacity for removing metal and mechanical efficiency of machines of the same dimensional capacity. If he asks for bids on a 20-inch, 10-foot engine lathe, and in one case is quoted $200 more than in another, he should have some means of knowing that the difference in price represents a difference in metal-removing capacity of the tool. Let me call attention to the phraseology that I have used in connection with this point; that is, to establish a method of rating, not to establish or standardize ratings themselves. Development is giving us light-powered and heavy-powered machines; each kind has its field but there should be some way to differentiate them besides by name.

Swing			Spindle Details							
Swing over Bed, Inches	Swing over Carriage, Inches	Maximum Distance Between Centers, 10′ Bed	Diameter and Thread of Nose	Taper of Hole	Taper of Centers	Diameter of Hole in Spindle	Threads per Inch of Lead Screw	Weight, Pounds	Circumferential Speed of Pulleys, Feet per Minute	Size of Tool
	12⅜	6′	3¼x4	Morse 5	M 4	1½		3800	375–500	⅝x1¼
20¼	12½	6′ 2″	3x6		M 4	1⅜		4000	660–843	
22½	14⅝	6′ 1″				1 9/16	4		445	
20½	12½	5′ 4″			1 43/64	1¼		4600	880	
22⅛	13¼	5′	3¼x5		Morse	1½	4	4200	660–825	¾x1½
21¼	13⅜	5′ 5″	2⅞x5		Morse	1 13/16		4190	807	
20⅛	13½	5′ 6″	2⅞x5			1¼		3300	600	⅝x1¼
22	14¼	5′ 9″			M 4	1½		4200	330	
21¼	12⅞	6′	2⅞x6			1 13/16		3800	347–460	⅝x1¼
20⅜	11⅜	6′ 1″	3x6			1⅜		3260		

TABLE II. COMPARISON OF CERTAIN DIMENSIONS OF TEN 20-INCH, 10-FOOT BED ENGINE LATHES

The Second Principle

The second principle refers to standardization of devices for holding cutting tools. The small-tool equipment of a shop represents a large investment. The more adaptable this equipment is, the fewer pieces there need to be in use, the greater the number of hours each small tool can be at work, and, therefore, the greater the operating efficiency of the shop. The interchangeability of lathe tools and tool holders throughout the tool posts of all lathes of a given size, the interchangeability of milling cutters and their collets among machines of different makes, the interchangeability of drill chucks throughout all the drillers of a given department, and so on, represent a real increase in efficiency which is so apparent as merely to need mention to be recognized. To show that this principle has already influenced design, I have but to refer to the taper of the hole in the spindles of millers. For the No. 2 millers, whose dimensions were tabulated, all had the hole in the spindle conforming to Brown & Sharpe's No. 10 taper. Similarly, for the No. 3 millers, the spindle taper was found to be uniformly Brown & Sharpe's No. 11. Again, the Morse taper is extensively used in driller spindles; in the ten 14-inch engine lathes investigated, the majority of the tool-post slots were found to be made for ½x1¼-inch tools.

The Third Principle

The third principle proposes to standardize devices for holding work and fixtures. The arguments presented in favor of standardizing the devices for holding cutting tools apply here with even greater force, for the devices and fixtures for holding work are more expensive as individuals than are separate cutting tools. Consider the advantages of having chucks interchanged throughout all of the lathes of a given size in a lathe department, or consider the advantage of uniform T-slots throughout all kinds of machine tools of relative, similar sizes. A milling fixture can then be used on any miller of a given number, holding-down bolts can be standardized as regards the sizes of the heads, with the full assurance that they can be used on a miller or driller, or planing machine, or lathe, as the case may be. In addition to the enormous saving in original investment and increased flexibility of the equipment, there is an attendant saving in the time required on the part of the workmen to find devices that can be used.

To show that something has been done in recognition of this principle I have but to refer to the table slots of millers. Of the millers investigated, the table slots were uniformly ⅝ inch.

The Fourth Principle

The fourth principle refers to the standardization of operating movements. Rapid repetition work depends very largely upon the sense of touch of the operator. Oft repeated movements become, to a great degree, involuntary. It therefore follows that a standardization of the operating movements of machine tools will contribute to an operator's speed by making his motions to an extent involuntary and permitting him to change from one make of machine to another without any disturbance to the habits that he has formed. On all standard lathes, the same direction of motion of the footstock handle should advance the spindle toward the head. Similarly a definite direction of motion of the handwheel on the carriage should advance the carriage toward the head, and so on for the other hand-operated movements.

To show that this principle has been recognized, in the engine lathes investigated the direction of motion of the operating handles was uniform to produce corresponding movements of the operating parts.

The Fifth Principle

The fifth principle sets forth the standardization of parts concerned with the setting up of machines with reference to permanent shop equipment. There are only a few points to be considered here, such as the spread of the bolt holes in the feet of the countershaft hangers, the drop of the shipper rod, and for motor-driven tools, the dimensions of the motor-feet pads. I understand that a committee of your association has consulted with a committee of electrical-machinery manufacturers in regard to this latter feature, but that thus far a working basis has not been reached. I need not dwell upon the advantage to the user in being able to buy a machine that meets his needs from a machine-tool builder, and a motor adapted to the machine from an electrical-machinery manufacturer, and assemble them himself with every knowledge that they will fit.

The Sixth Principle

The sixth principle refers to an acceptation of the geometric progression as a fundamental requisite in determining relations throughout the chosen ranges for feeds and for speeds. I have reason to believe that this principle is very generally recognized among you, especially among those producing millers. But there seems to be a wide difference in the ratios aimed at. Personally I am not in a position to make any definite recommendation along these lines, other than to state the general principle.

The Existing Lack of Uniformity

To make my argument complete, it is evidently necessary to prove that a lack of uniformity exists in connection with the features covered by the principles outlined above, and at the same time that these differences are of such a nature as to indicate that uniformity can be established. To meet this requirement four tables are presented herewith. Two refer to lathes and two to millers, and give, respectively, an analysis of many of the features capable of being standardized for 14-inch and 20-inch lathes, No. 2 and No. 3 millers. Had time permitted it would have been of value to have extended this analysis to drillers and planers.

The following lists of features to be considered for standardization are for the four fundamental machines, lathes, planers, drillers and millers. This does not imply that standardization cannot be carried on in connection with some other machines, but the limit of time prevented a consideration of them. However, the principles laid down are of such a nature that they can and should be applied to all classes of machine tools that are of a fixed type and made by a number of builders.

The real work of determining dimensions is a long, tedious task, and cannot be done in a weak-kneed, faltering manner.

Personal experience in the work of standardization has taught me that the difficulties in the way are always magnified. The way is easily found if there is a will to do.

What follows is by way of suggestion.

Engine-Lathe Features to be Standardized

Designations and capacities might be linked together by giving three dimensions: First, the swing over the ways; second, the swing over the plain carriage; third, the maximum distance between centers. Thus a 14-inch, 6-foot bed engine lathe would become, say, a 14x8-inch by 3-foot engine lathe. The maximum swing over the ways should be fixed for each nominal swing; the other dimensions to be exact.

As a suggestion merely, is it necessary to have so many nominal sizes of lathes as are now built and listed? As now arranged, these sizes roughly form an arithmetical progression, having a common difference of two inches. Has anyone considered arranging these sizes in a geometric progression with the direct purpose of reducing their number? If anyone is interested in this speculation let him start a progression with ten inches and apply the ratio 1.2.

A standard method of power rating might be to give the horsepower of the driving belt for the machine; this power to be figured by means of a determined formula with determined factors for single, double and triple belts. This same rating could apply whether the machine was belt driven or motor driven, for a given type and size of machine is usually built for both methods of applying power. This will permit a careful designer to develop a design and have a proper relation between power and rigidity. It will also permit the user to compare mechanical efficiencies.

For each nominal size of lathe the following details of designs should be standardized: The diameter, thread and length of the spindle nose; taper of hole in spindle; diameter of hole through spindle; taper of the centers; hole, keyway, face, pitch, and kind of teeth of change gears for the ordinary screw-cutting type; number of threads per inch of the lead screw; size of T-slots in wings of carriage, direction of motion of operating handles, controlling movements of footstock spindle, carriage, tool block and compound rest.

Vertical Driller Features to be Standardized

Features of vertical drillers that should be standardized for each nominal size are: Dimensions of table and of finished surface of base; distance from center of spindle to face of column; method of power rating; dimensions of the spindle nose; taper of the hole in the spindle; number, arrangement and size of T-slots in the table and base; maximum distance from spindle to table and from spindle to base; direction of motion of operating handles.

Spindle Details					Table Details					Column Details						
Thread on Nose	Taper Hole in Spindle	Width of Slot in End of Spindle	Distance Column Face to Spindle End	Thread of Draw-in Bolt	Working Surface of Table	Number of T Slots	Size of T Slots	Spacing Center to Center of T Slots	Telescopic Screw	Width of Face of Column	Solid Angle of V on Column	Distance Column Angle Extends above Spindle Center	Over Arm Diameter	Outboard Arbor Bearing Diameter	Circumferential Speed of Pulleys, Feet per Minute	Weight, Pounds
2½ diam. 4 threads per in. L. H. U. S. S.	10	none	1⅞	none. Bolt not furnished	39¼x10¼	3	⅝	2½	yes	9¼	50°	5½	3½	1⅛	450 550 505	2850
2 diam. 8 threads. U. S. S.	10	none	3¼	⅝–11 threads	43⅞" long 10" wide	3	⅝	2 7/16	yes	10	45°	2¾	4¼	2⅜	510 650	3050
2½ diam. U. S. S. 4 per in. L. H.	10	none	3	⅝–11 U. S. S.	39x10½	3	⅝	3	yes	9¾	50°	3½ below	3¾	1⅜ and 1⅝	420 470	2600
5 per inch	10	1 7/16	3⅜	12 threads per inch	11¼x47¼ length over all 52	3	⅝	2½	yes	10¼	45°	2½	3¾	1 1/16	580 785	2460
2¼x12	10	none	1⅜	⅝ No. 11	41x10	3	⅝	2¼	yes	9½	40°	about even	4	1⅛ and 1¼	590 730	2850
2½ diam. 1¼ lead, ¼ pitch. U. S. S.		1 3/64	3¼	⅝–11 threads	47¼ long 11 wide	3	⅝	2 7/16	yes	10¾	45°	2⅝	4¼	2⅜		

TABLE III. COMPARISON OF CERTAIN DIMENSIONS OF NO. 2 MILLERS

Planer Features to be Standardized

The features to be standardized in connection with planers are: A method of rating; method of stating capacity; number and size of T-slots in the platen, and dimensions of reamed holes in platen; direction of motion of operating handles.

Miller Features to be Standardized

In the planer, driller, shaper and lathe we have a precedent for a form of designation that of itself indicates capacity. Is there any good reason why miller should not be

styled in a similar manner? To illustrate: is not a designation "a 25x8x18-inch universal miller" better from the viewpoint of conveying information, than to say, "a No. 2 universal miller"?

Features to be standardized in connection with millers are: Designation and capacity; a method of rating; length and width of working face of table, maximum distance from center of spindle to table; thread on nose of spindle, diameter of nose; taper of hole, width of slot in clutch end; diameter of clutch end, and distance from face of column to end of spindle; nose and taper of hole of spindle of vertical attachment and index head; diameter of over arm, distance from center of arm to center of spindle; diameter of bore for outer arbor bearings; width of face of pillar and solid angle of edges, distance face extends above spindle center; number, size and spacing of table slots; diameter and thread on draw-in bolt; general position and direction of motion of operating handles.

base, a planer platen, the wings of an engine-lathe carriage, or the table of a shaper.

If there is an advantage in being able to exchange chucks throughout the individual machines of a lathe department, is there not an added advantage if these same chucks can be used on certain sizes of millers? To put it a little more concretely, why should not the spindle noses of 16-inch engine lathes and No. 2 millers be identical, and again why should not the noses of No. 3 millers and 20-inch engine lathes be the same?

Turning to our fourth principle of standardization, should not the general position and direction of motion of the operating handles of a 14-inch lathe correspond with those of a 20-inch lathe? Should there not be similar uniformity between a No. 2 miller and a No. 3 miller, and so on?

Referring to our fifth principle of standardization, should not the spacing of the holes in the feet of countershaft hangers for countershafts of approximately the same weight and subjected to the same stresses, be uniform, without reference to the machines they are used with? The advantage of such standardization in aiding the locating, spacing and setting up of countershaft stringers is apparent. Again, should not the pads for the feet of a 3-horsepower motor to be applied to a lathe be identical with those for a similar 3-horsepower motor to be used on a miller?

As another general point, no screw or other part should be tolerated that has a travel of such a length that a hole must be cut in the floor to accommodate it. Machine users cannot countenance the cutting of holes in shop floors, particularly in buildings where the materials of construction are fire resisting.

It may seem to you that I have mentioned many points where uniformity already exists. If such is the case, the work of standardization is made all the easier, for all that is necessary is for your association to adopt them formally as your standard.

Finally, I wish I could make you feel the enthusiasm with which this matter has been received by *all* the machine users with whom I have discussed it. From the viewpoints taken, it has been evident that the advantages of such uniformity will not only be felt in large manufacturing departments of machine shops, but likewise in the tool-making room and in the job shop. Its advantages in all three of these places have been emphasized to me. One superintendent said in substance, the tool room is the place where the greatest good from such uniformity will be felt, for there the work is special, there we feel need of interchanging tools between machine and machine, and the equipment will be made truly elastic if details are standardized. A works manager said: "Our large manufacturing departments are the ones that will be benefited by the establishing of such uniformity." And the proprietor of jobbing shop added: "Such standardization will save me money every day, besides permitting me to buy new machines of makes that I favor but have not deemed it right to purchase in the past because in many of the essential details they differed from the equipment already in use. Should I have bought these machines I would have also had to buy a special small-tool equipment to go with them."

One enthusiast expressed himself by "Me for it"; while another man who has influenced the buying of some $750,000 worth of machine tools during the past eight years, said: "Standardization of machine tools as you have outlined it is the greatest constructive step in machine-tool design that I can imagine."

Spindle Details					Table Details					Column Details						
Thread on Nose	Taper Hole in Spindle	Width of Slot in End of Spindle	Distance Column Face to Spindle End	Thread on Draw-in Bolt	Working Surface of Table	Number of T Slots	Size of T Slots	Spacing Center to Center of T Slots	Telescopic Screw	Outboard Arbor Bearing Diameter	Width of Face of Column	Solid Angle of V on Column	Distance Column Angle Extends above Spindle Center	Over Arm Diameter	Circumferential Speed of Pulleys, Feet per Minute	Weight, Pounds
3¼ dia. 3½ threads per in. L. H. U. S. S.	11	1½	1⅞	None. Bolt not furnished	53x12¼	3	⅝	3	Yes	2⅛	11½	50°	6¼	4¼	760 600	4350
2½ dia. 6 thds. U. S. S.	11	None	3	⅝–11 threads	52 long 12 wide	3	⅝	2⅝	Yes	2⅞	10⅞	45°	2½	4½	765 1225	4350
3¾ dia. U. S. S. 4 per in. L. H.	12	1½	3¼	¾–10 U. S. S.	48½x13	3	⅝	3½	Yes	1⅞ and 2¼	12	50°	4 in. below	4½	1640 1640	6700
5 per inch	11	1 9/16	3⅞	12 threads per in.	13½x58¼ 63 over all	3	¾	2½	Yes	1 1/16	12	45°	4½	4⅞	660 800	4200
2½x12	11	None	1½	⅝ No. 11	49x12	3	⅝	3½	Yes	1⅛ and 1 1/16	10½	40°	6½	4½	715 1080	4200
3¼ dia. 1⅜ lead, ¼ pitch. U. S. S.		1 3/16	3¼	⅝–11 threads	55¼ long 13½ wide	3	⅝	2⅞	Yes	2⅜	11¾	45°	2¾	4½		

TABLE IV. COMPARISON OF CERTAIN DIMENSIONS OF NO. 3 MILLERS

Intersize and Interclass Standardization

Thus far my argument has been directed toward standardization within the general limits of a given size of a given kind of machine. We must also consider the advantages of interclass standardization. But this discussion cannot be carried very far until detail dimensions have been tentatively determined upon for the various sizes of the various classes.

The establishing of a standard method of power rating has been touched upon. It is evident that such a method would apply to all sizes and all classes of machines.

Turning to details of design, a ⅝-inch T-slot should have the same dimensions whether it is in a miller table, a driller

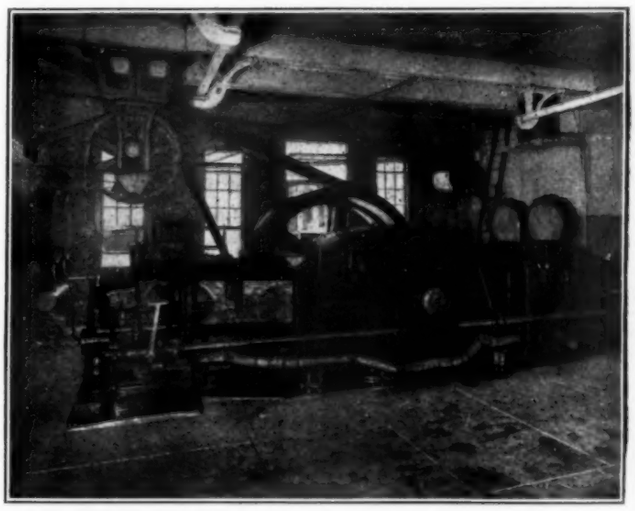
Gas Power in the Machine Shop

Editorial Correspondence

A successful installation of gas engines in a large machine shop, where six years of use and much overtime work have proved their reliability. The power, distribution and lighting apparatus of the plant.

Gas power has not been widely adopted in machine shops, for there is a prejudice against the gas engine. It is considered unreliable. That this is today an unfounded opinion is shown by the large number of successful gas-engine installations throughout this country and particularly throughout Europe. It is the purpose of this article to show one such installation that has been in successful operation for several years in a large machine shop.

The original gas-power plant of the New Departure Manufacturing Company, Bristol, Conn., was started in April, 1906. It is a 350-horsepower Crossley engine, belted to the shafting of the older machine-shop building. See Fig. 1. A later installation was of another 350-horsepower Crossley engine to furnish power for a building situated on the other side of the street that passes through the New Departure plant. The second installation also included a 160-horsepower gas engine, driving a lighting generator. The third and last installation consisted of one 250- and one 500-horsepower twin-tandem engine, direct connected to an alternator. These three installations are shown in Figs. 1, 2 and 3.



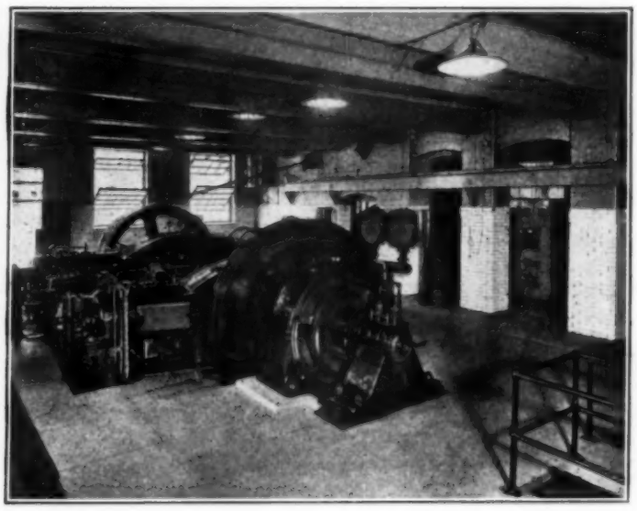


FIG. 1. TWO OF THE GAS-ENGINE PLANTS FIG. 2

THE GAS PRODUCER

The arrangement for handling coal and the charging floor of the producers are shown in Figs. 4 and 5. Here the coal is discharged from cars at a level some 15 feet higher than the charging floor, and is handled by means of wheel-barrows to the floor itself. There are four Loomis & Pettibone suction-producers.

Two gas holders are installed in the yard; the larger is shown in Fig. 6. This has a capacity of 15,000 cubic feet, and is used for the producer gas. The second is smaller, having a capacity of 5000 cubic feet, and is used for the water gas generated as an incidental to the process of making producer gas. This water gas is used to fire some of the furnaces in the hardening room and for small blow pipes and gas forges throughout the manufacturing departments.

An interesting point has been brought out in its use. At first there was objection on the part of some of the men, as they believed that this gas was in some way injurious to the health and dangerous, compared with the ordinary city gas. A careful trial, however, demonstrated that the workman could not tell whether they were using water gas or city gas, and since that demonstration there has been no objection whatever to the kind of gas furnished.

Turning again to Fig. 6, at the extreme left will be seen two of the scrubbers. Emphasis must be laid upon the necessity of keeping them clean, as has been demonstrated by the experience of this plant. If they are allowed to become foul the gas may reach the engine in such a condition that back firing will be frequent. The present practice is to clean carefully the scrubbers once each week. This procedure has been found to give gas of such a cleanliness as to be entirely unobjectionable from an operating standpoint.

The help needed for the producer plant is one man in charge and two helpers. When the plant is shut down for the night the gas receiver is left filled to be in readiness for starting in the morning. The producers themselves are started between 5.30 and 5.45 a.m. The gas begins to be made about 6.50 a.m., as the engines must be in operation before work begins in the shop at 7. Under ordinary conditions about 3000 feet of gas are made per minute.

The amount of horsepower generated under ordinary requirements for power and lighting is 1000 horsepower. This amount is generated with the use of five net tons of anthracite coal per 10 hours, giving a factor of about 1 horsepower per pound of fuel. The engines of the original installation have been well able under tests to meet their guarantee of a horsepower-hour per pound of fuel. The new engines, however, have not been quite so economical, due to a difference in operating conditions.

The number of employees under normal working conditions is 1200, giving a factor of five-sixths of a horsepower per employee.

RELIABILITY OF THE PLANT

The reliability of the plant is considered fully equal to that of the ordinary steam plant. The old plant ran 23 hours per day, 6 days per week for a period of three years, 1907 to 1910. This meant but one hour of shutdown each 24 hours of the week days and a shutdown, of course, on Sunday. During the period from January 1, 1911, to the date when mater-

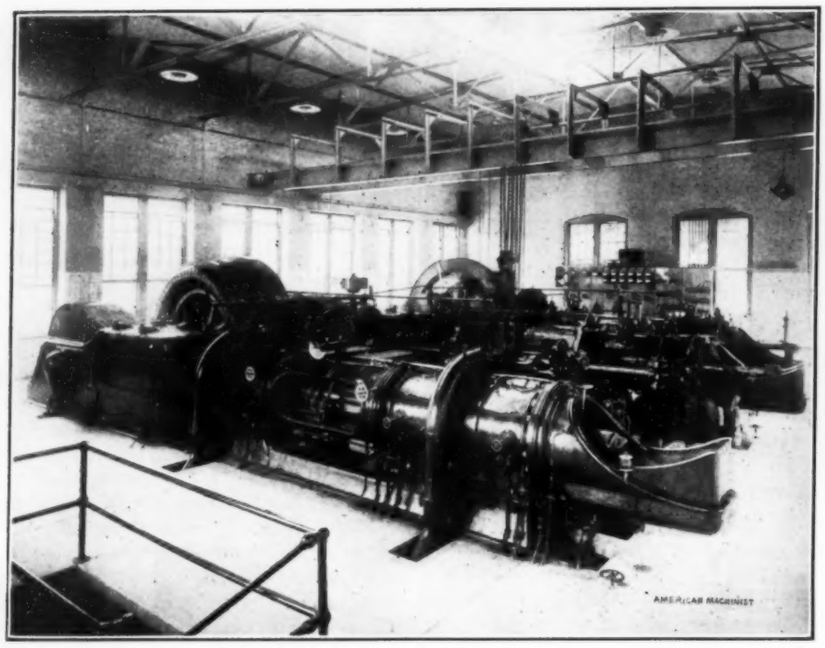


FIG. 3. THE LARGEST AND MOST RECENT INSTALLATION

FIG. 6. ONE OF THE GAS HOLDERS

ial for this article was collected, about August 1, there had been but two shutdowns, each of about 15 minutes' duration. Each was to make minor repairs.

PROVISION FOR HEATING THE BUILDINGS

The plant is advantageously situated on the banks of a small stream or river, from which an ample supply of water can be obtained for the scrubbers and for cooling purposes. All of this water is discharged directly into the river, and no attempt made to save the heat which it contains.

For heating the plant, a battery of four 150-horsepower horizontal return-tubular boilers is in use, operating under a pressure of 80 pounds of steam. During the summer one of these boilers is kept under pressure to furnish steam for washing, electroplating and other industrial purposes throughout the plant. In winter others are put into service as required, to furnish steam for the combination of indirect- and direct-heating apparatus that is employed. The necessity of an auxiliary steam plant for heating purposes, particularly in our Northern climate, has been urged as an objection to employing gas power in a machine shop.

THE DISTRIBUTION OF POWER

Referring to Figs. 1, 2 and 3, it is seen that part of the engines are belt connected to the transmission shafting of the buildings in which they are located, and that the others are used to drive generators supplying current for power and lighting purposes. The regular power circuits of the plant are three phase, 25 cycle, 480 volts, alternating. These circuits supply 65 induction motors situated throughout the plant. The regular lighting circuit is 110 volts, direct. From this circuit, however, there are operated three motors aggregating 40 horsepower in rating.

Because of the necessity for running nights, which has been occasioned by the enormous growth of the business of the company, there is a limited number of motors, aggregating 50 horsepower, that run continuously from the city service, which is 500 volts, direct. In addition thereto there are 270 horsepower in 10 motors, which can be used for night work and overtime work if desired, and these are operated from the outside circuit. Thus, it is seen that there are three kinds of current used throughout the plant, because of the extended and varying needs of the manufacturing departments. The total horsepower of the motors aggregates about 1000, excluding the 270 horsepower of auxiliary motors, which are in readiness for overtime work.

Two typical illustrations of motors are shown in Figs. 7 and 8. Here the motors are seen carried on wooden frameworks, suspended from the ceilings, belt connected to the line shafting and with the

FIG. 4. THE COAL-STORAGE YARD

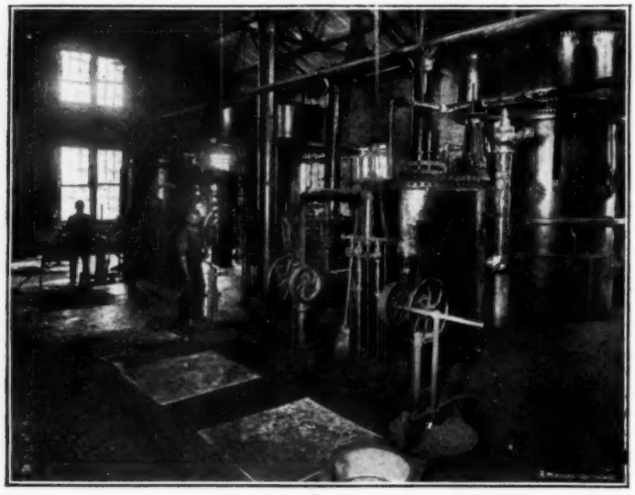
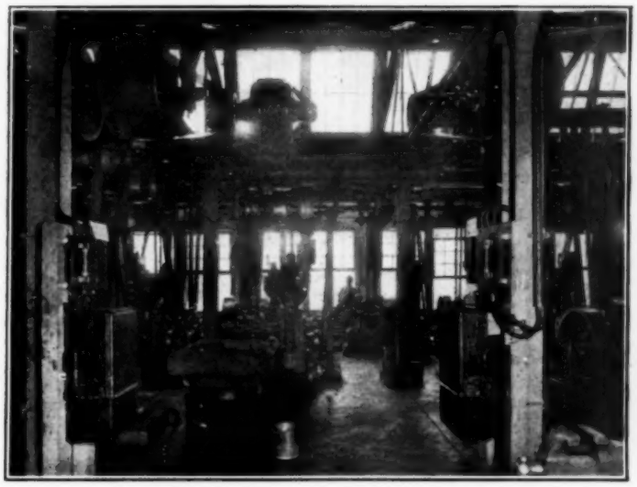


FIG. 5. THE PRODUCING CHARGING FLOOR



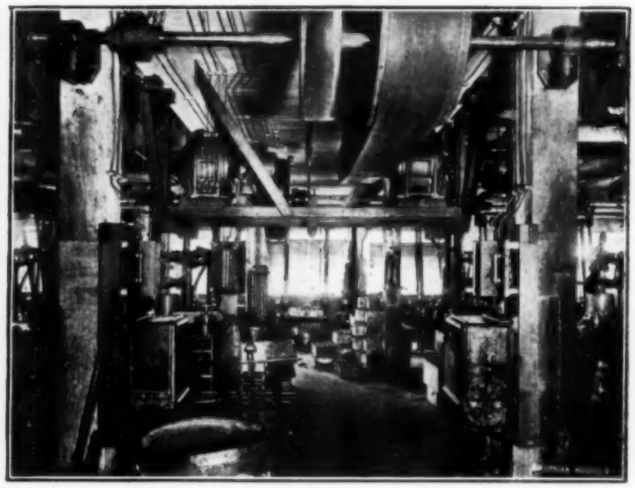


FIG. 7. TWO MOTOR INSTALLATIONS, SHOWING SWITCHES, FUSES AND WIRING FIG. 8.

wires carried in open-cleat work to oil switches, placed at convenient hights and locations on interior columns of the building. Fig. 7 shows very clearly two of these switches in the foreground with a set of cartridge fuses above and the wiring carried in metal conduits, passing up the columns to the ceiling. On the ceiling the wiring is ordinarily run open, as shown in Fig. 8.

Another point in Fig. 8 that should be noted is the lighting circuits' cutout board in about the middle of the halftone. This is so arranged that all the lights on

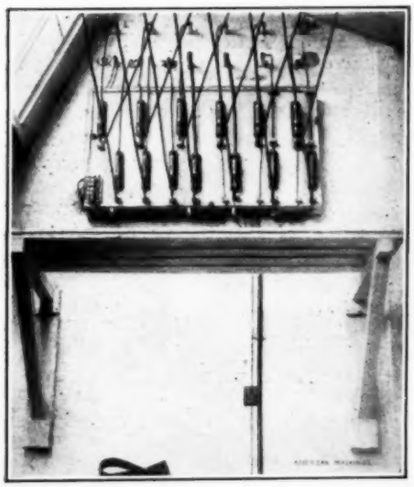


FIG. 9. WHERE POWER AND LIGHTING MAINS ENTER ONE OF THE BUILDINGS

the floor are controlled from this central point.

Fig. 9 shows a fuse board where the circuits enter one of the main buildings, and from which point they are distributed. But little comment is necessary, for the method of installation is plainly shown.

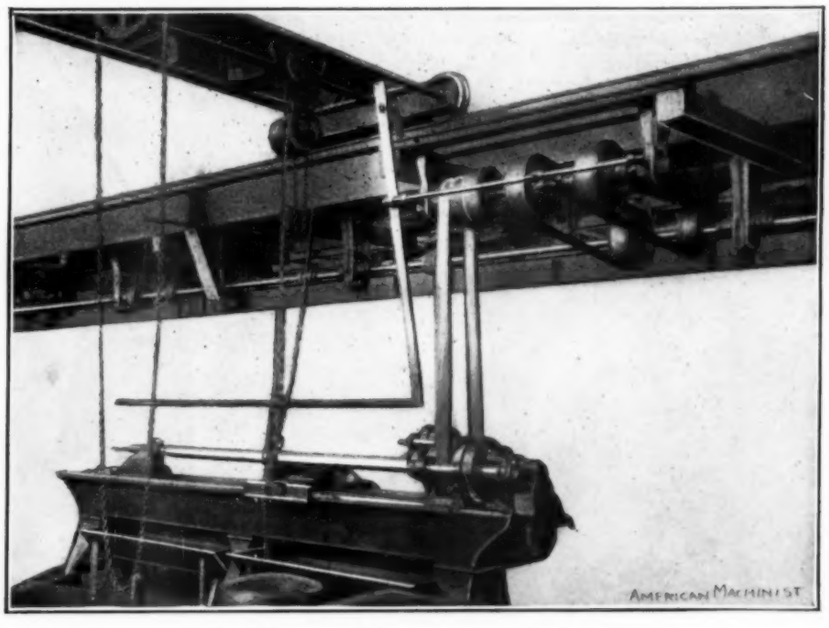
THE LIGHTING INSTALLATION

The shop is lighted by a combination of incandescent, tungsten and inclosed arc lamps. The incandescents are 16 candlepower 55 watt, and 10 candlepower 35 watt. The tungstens are 25, 40, 60, 100 and 150 watt. The inclosed arcs, of which there are only a very few used in the plating room, drafting room and printing shop, are of six-ampere rating. In general the 10-candlepower incandescents are used as drop lights over individual machine tools, although a number of 16-candlepower is also used in this same way and for this same purpose. The 25-watt tungstens are used for general illumination with a limited number of 40-watt tungstens for this same purpose in special locations. The other tungsten lamps, that is the 60-, 100- and 200-watt sizes, are looked upon as specials and are used very little outside of the offices and a few locations where an intense illumination is considered necessary.

Factors giving the amount of horsepower per square foot of area and the number of square feet of floor space per employee are always of interest in connection with machine shops. The total amount of floor space in the New Departure plant is 235,000 square feet. This gives a factor of about 200 square feet per employee and 235 feet per horsepower of power delivered by the gas-engine plant.

A Set-Out Countershaft

The Lucas Machine Tool Company, Cleveland, Ohio, has a method of setting out the countershafts on its big lathes, as shown in the accompanying halftone, that enables them to place work in the lathe direct from the traveling crane without any unnecessary trouble or interference from belts or cross beams. As the engraving shows, the line shaft runs down the shop directly under the heavy steel beams over which runs the track for the traveling crane. Bolted to the beams are two heavy wood crosspieces projecting out over the lathe headstock, to which the countershaft is bolted, which arrangement gives a clear runway for the crane and facilitates the handling of work.



AN EXTENDED COUNTERSHAFT SUPPORT

A Complete Hardening Department

By E. A. Dixie

The hardening room of the Waterbury Farrel Foundry Co., Waterbury, Conn. Arrangement of the water, brine and oil tanks and the various furnaces.

The hardening room of the Waterbury Farrel foundry is probably as well equipped for the class of work handled as any in the country, and occupies very little space if one takes into consideration the quantity of work passed through it.

A plan of the room is shown in Fig. 1. The tank *A*, shown also in Fig. 2, is for water hardening and in it city water or that from the Naugatuck river is used.

In the center at the bottom is a large inlet pipe controlled by one of the valves above. Equally spaced around the inside and close to the wall are several vertical pipes reaching to near the surface. These are capped on the end but slit from top to bottom to permit the water to escape sideways, thus keeping the water in the tank agitated and presenting large quantities of fresh cool water to the surface of the work, which is so desirable when large pieces are being hardened.

A vertical stream from above is also provided as shown in Fig. 2 at *N*. This view was taken from the position marked *X* in Fig. 1.

For hardening the holes in such work as dies, a very ingenious fixture has been installed on this tank. The lower plate on which the work is placed is marked *O* in Fig. 2. The fixture is shown in detail in Fig. 4. Secured to the water pipe *A* is the member *B*. The member *C* is bored large enough to slide easily on *A*, and is connected with the member *D* by the two rods *H* which slide freely through the member *B*. The lock nuts on the members *H* permit *D* to be adjusted to or from the nozzle *F*. The mechanism *C, H, H, D* is raised and lowered by the toggle mechanism with the handle *G*. In operation the cold die *E* is placed on the member *D* and the handle *G* is thrown down, thus raising the member *D*. The locknuts are then adjusted so that the point of the nozzle *F* bears the desired relation to the hole in the die *E*. The lever *G* is then raised, the die *E* taken out, heated and returned to its position on *D*. The lever *G* is thrown down and the water turned on.

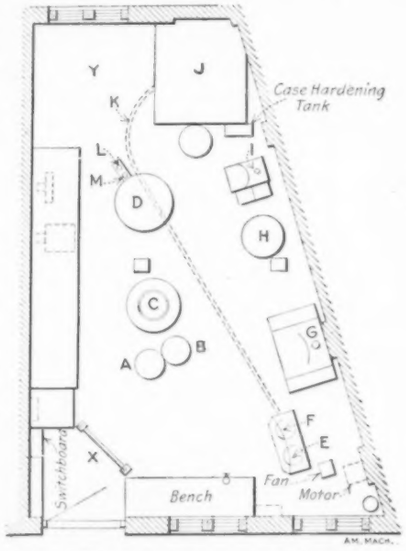


FIG. 1. FLOOR PLAN OF THE HARDENING ROOM

The tank *B* is for hardening in brine and it is connected with the brine circulating system which will be referred to later. Besides the circulation in the tank itself the vertical pipe *N* can also be swung to serve the tank *B* as cocks and valves are provided to cut off the city water supply and connect with the brine circulation.

The tank *C* is for oil tempering; this tank is double. The inner tank accommodates two barrels of fish oil. In the outer tank water is circulated so as to carry off the heat from the oil. At *P* is shown a handy little automatic self supporting hook on which the wire baskets are hung to drain. This is also shown in detail in Fig. 4.

The large tank *D* shown in Figs. 1, 2 and 3, is on a level with the floor. It is large enough to handle anything that may come to the hardening room, and is provided with connections for both the city water mains and the brine circulation system. Referring to Fig. 1 the overflows are shown at *L* and *M*, *N* leading direct to the sewer and being used when city water is used. When brine is used *M* is plugged and the brine passes over it and flows into *L* from whence it is pumped to the brine storage tank above. When not in use the tank *D* and the two overflows *L* and *M* are covered.

At *E*, Figs. 1 and 2, is the usual lead pot for heating such work as reamers. At *F* is a barium chloride furnace.

Work such as chisels is heated in the ordinary forge shown at *G*, Figs. 1 and 2.

The furnace shown at *H* is for drawing

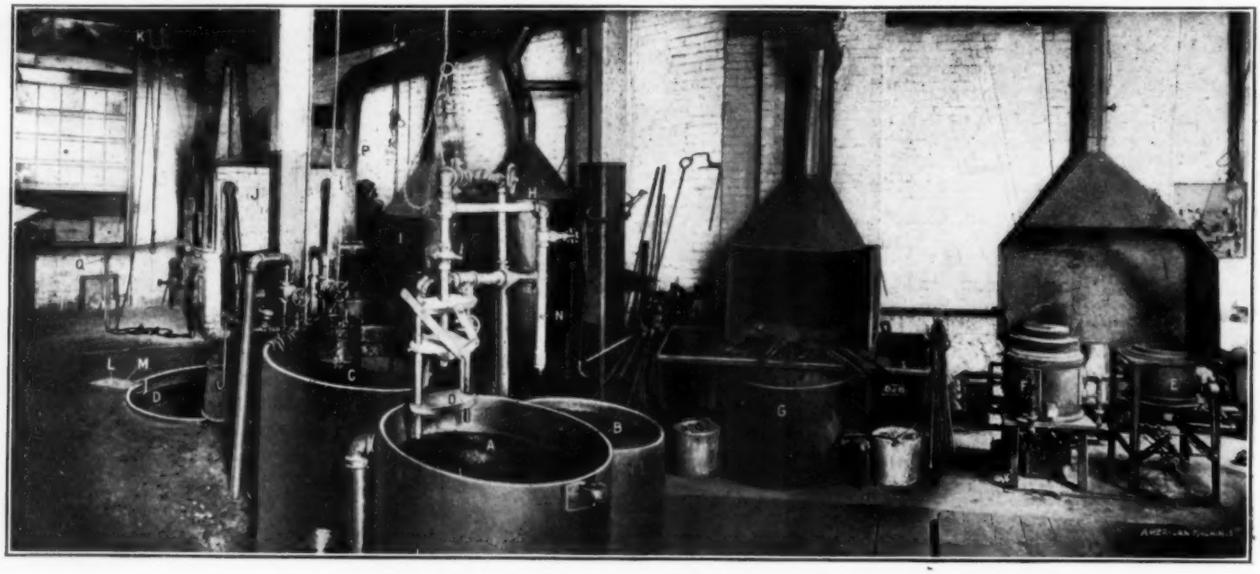


FIG. 2. THE HARDENING ROOM FROM *X*, FIG. 1

FIG. 3. THE HARDENING ROOM FROM *Y*, FIG. 1

in hot oil. Cyanide hardening is done in the furnace shown at *I*, Figs. 1 and 2. This is provided with the usual hoods and exhaust to carry off the fumes. Tanks for cooling are right alongside it.

Large pieces such as dies are heated, and pack hardening, annealing, etc., are handled in the large furnace shown at *J*, Figs. 1, 2 and 3. At *Q*, Fig. 2, in front of the large furnace is shown a very clever device in the shape of a collapsible platform or slide for handling work

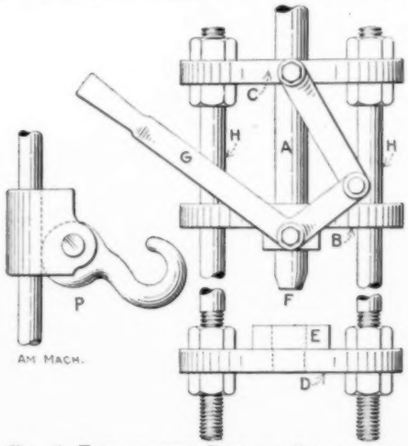


FIG. 4. TWO OF THE DEVICES SHOWN IN FIG. 2

into and out of the furnace. This is shown in detail in Fig. 5. Normally it is in the position shown by dotted lines at *A* Fig. 5; one member only is shown to avoid confusion. When heavy work is to be placed in the furnace, it is swung out to the position shown in full lines at *B*. When in this position the work is easily lifted on to the platform. When removing work from the furnace the lower part of the device is swung out and the work is easily slid on it to the floor.

An overhead trolley *K*, Figs. 1 and 2, serves all the furnaces and tanks.

The room is equipped with the usual hardening-room instruments but I suspect that here as elsewhere successful hardening depends more on the senses of the man in front of the furnace than on the pyrometers, etc., behind it.

All the steels used in the Waterbury Farrel Foundry and Machine Company are painted a distinguishing color on arrival, and all tools of high-speed steel when made are stamped with a distinguishing mark so that the hardener may know how to treat them. On the wall of the forge shop is a chart giving the colors the various makes of steel are painted, the marks stamped into the various makes of high-speed steel tools by the tool smith and a tempering color chart

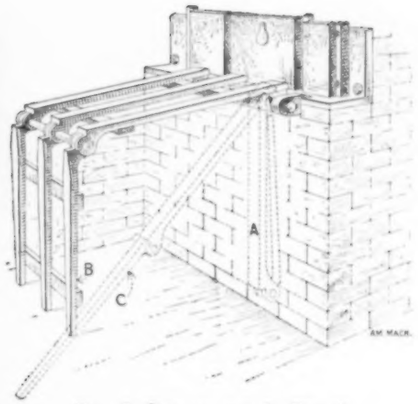


FIG. 5. DETAIL OF *Q*, FIG. 2

with temperatures. A similar chart hangs on the wall of the hardening room.

Fig. 6 shows the hardening card that goes along with each order. Besides any notes that may be made at the foot of the card the hardener has a rubber stamp with which he stamps the back "heated to .....; drawn to ....." the temperatures for each being filled in on completion of the work. These cards are filed away and form a valuable ready reference in case of repeat orders for work that has been previously handled either successfully or otherwise.

A Change from Belt to Motor Drive

The extent to which motor drive results in a saving of power is largely dependent upon the convenience of the control of the starting and stopping of the motor. To avoid loss the operator must be encouraged to shut down the machine the minute power is no longer needed.

An example of an automatic type of motor starter applied to a machine tool as well as a simple method of changing a belt-driven miller to motor drive is shown by the illustrations.

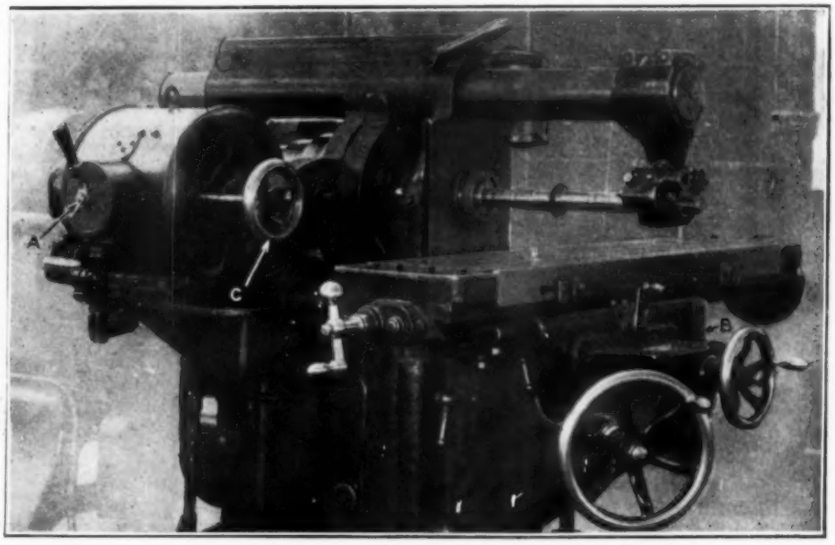


FIG. 1. MILLER EQUIPPED WITH MOTOR DRIVE AND AUTOMATIC STARTER

The automatic starter is placed in an inclosed iron case on a nearby post and is controlled by drum switch *A* at the motor, and *B*, Fig. 2, placed under the table at the opposite side of the machine. Switch *B*, which is the most used, has three points, start, stop and dynamic brake. Switch *A* on the motor is for reversing and is used when changing from right- to left-hand milling cutters. If desired, it may also be used for starting and stopping. Throwing a switch to a desired position is the only act necessary on the part of the operator.

It will be noted from Fig. 2, that the conduit carrying the wires is tapped directly into the switches and that there are no exposed contacts about the machine.

The proper speed adjustments to suit different materials and diameters of cutters are controlled by the handwheel *C*. Turning this handwheel shifts the motor armature causing the speed to change to the exact point desired. After the speed has once been set the operator may shut down the machine and start it up again without further attention to the speed adjustment. This is possible with the armature shifting type of adjustable speed motor because the speed control is in no way connected with the starting and stopping.

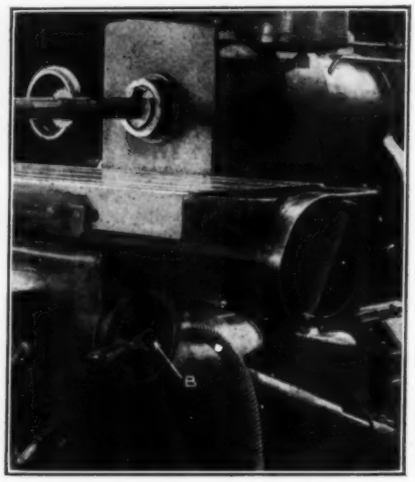


FIG. 2. MOTOR DRIVE APPLIED TO MILLER

In changing the machine from belt to motor drive the cone is removed and the largest step is turned to a straight face. On this is placed a ring gear. The drive to this is through a raw-hide idler which is supported by a stub shaft fastened to a boss on one of the arms of the motor end yoke.

Outside of the motor and starting equipment the only parts necessary for making the change are the bracket *E* on which the motor is mounted, a steel motor pinion, rawhide idler, ring gear on cone pulley and gear guards.

The motor shown in the illustrations is a two-horsepower adjustable-speed motor of the armature shifting type with a speed range of 400-2400 revolutions per minute, manufactured by the Reliance Electric and Engineering Company, Cleveland, Ohio. This drive with and without the back gear gives an unbroken range of spindle speeds of 10 to 360.

Fixtures and Toolroom Methods

By R. C. Greenerd

A number of shop jigs and fixtures of considerable suggestive value to the average mechanic.

A novel broaching fixture in which pins are substituted for internal threads.

Suggestions and tools for sharpening miller tailstock centers and lathe centers of various tapers, and an unusual method of laying out jig plates.

In the shop of the American Tool and Machine Company, Hyde Park, Mass., ball races are made by first cutting a tool-steel bar into disks, 16 at a time, with a gang of saws, the 2½-inch bar being held in the regular miller vise by means of the jig shown in Fig. 1, which consists simply of two shaped plates or combs set into the vise as illustrated and kept from slipping in at the bottom by two stop pins, one of which is shown at *A*. After these disks have been roughed out they are hardened, drawn and then ground to size, the outside diameter being ground first while the ball race is held on the mandrel shown in Fig. 2, it being slipped onto the turned triangular piece *A* and the other taper-turned piece *B*, pressed on and tightened with the lock nut *C*. Next the ball races are placed in the chuck, Fig. 3, and the inside and one side ground, the piece being held in the chuck by screwing in the taper-head screw *A*, which expands the split section *B*; then they are held on the faceplate of the fixture shown in Fig. 4, by an expanding plug, and the ball races ground, the necessary circular motion being given by swinging the fixture on its center by means of the handle. Feeding is done by using the screw *B*, and a change in radius is made by adjusting the head *C* on the cross slide *D*.

SLOTTING TOOLPOSTS

Slots in toolposts are drilled out in the jig shown in Fig. 5, the toolpost *A* being held in the jig by means of the setscrew *B*. The cover *C* carries the drilling bushings *D*, *E*, *F*, *G* and *H*, and fits the dovetail of the jig, being located for drilling the various holes in the toolpost by means of the pin *I*, which fits the bushing *J* in the body of the jig and also the straight row of bushings in the sliding cover. A bushing at *K* is used to drill the setscrew hole in the end of the toolpost. The use of this jig leaves a nice, straight slot with very little to mill out for the finish.

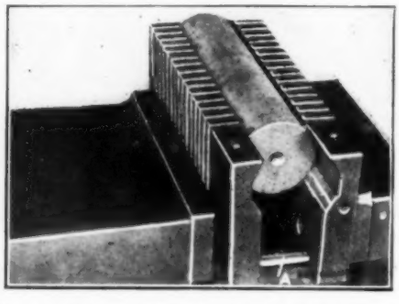


FIG. 1. MILLING JIG USED WHEN CUTTING BAR INTO DISKS

Cast-iron bushings, 3½ inches in diameter, have a number of ⅜-inch holes drilled in them in the fixture shown in Fig. 6. This fixture carries a master bushing *A* connected by the gears *B* and *C* to a mandrel over which a bushing *D* is placed. The master bushing *A* is indexed for its different positions by handle and latch pin *E*, the carriage holding the two bushings sliding in the base to accommodate the distances of the holes lengthwise. As each hole is indexed in the master bushing, a corresponding one is drilled at *F*, in the cast-iron blank.

DRILLING AND GRINDING WASHERS

Large steel thrust washers cut from the bar are drilled out, as shown in Fig. 7. In this jig the washers are each held by two pins and a single clamp, having two screws, one to hold the clamp in place and the other to lock it, a slight turn of the head with a wrench answering the purpose.

As soon as one washer is drilled the jig is easily indexed to the next one by pulling out on lever *A* and turning the revolving plate one notch. After these washers have been hardened, they are ground by placing them on faceplates like those in Fig. 8, which are fitted with a number of expanding plugs over which the washers are placed and locked by tightening nuts at the back of the plate. In order to allow for inequalities on the surface of the washers and also to keep

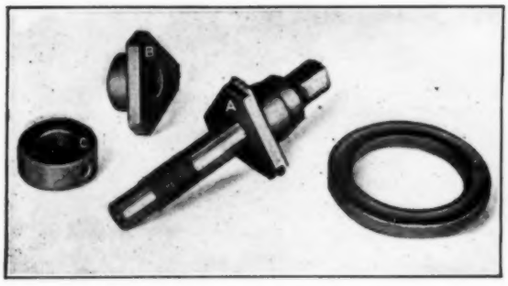


FIG. 2. MANDREL FOR HOLDING BALL RACES WHILE GRINDING OUTSIDE

FIG. 3. BALL RACE CHUCK

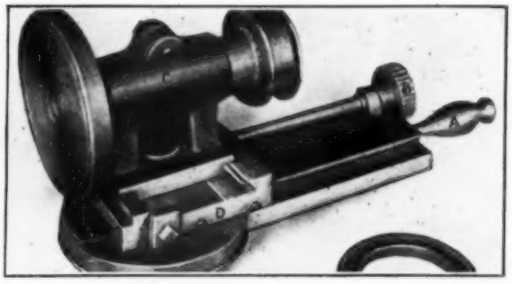


FIG. 4. FIXTURE USED WHILE GRINDING OUT THE GROOVE

dirt or chips from letting them seat properly, three pins are set around each expanding plug for the washers to rest on. When one side has been ground, the washers are put on the other side out and finished.

CUTTING DOVETAILS

An adjustable dovetail cutter for use in the vertical miller is shown in Fig. 9, which consists of a spindle *A*, carrying a dovetail milling cutter, and the shank of which is inserted in the spindle of the miller. This spinde *A* is connected by a cast-iron bracket and gears to a second similar spindle *B*, also carrying a dovetail milling cutter. Bracket *C* is bolted to the miller head in order to steady the cutters when in operation, and angular adjustment of the cutters so as to cut different widths of dovetails is made by means of the slot *D* and lock bolt *E*. A sample of the work done with this attachment is shown at *F*.

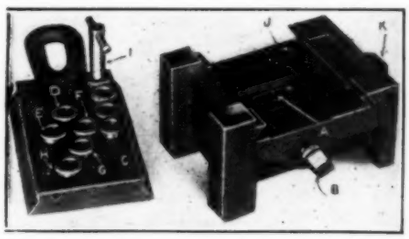


FIG. 5. TOOL-POST DRILLING JIG

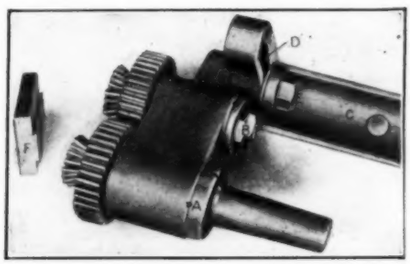


FIG. 9. DOVETAIL MILLING FIXTURE

NOVEL METHOD OF ROUGHING OUT STEEL GEAR BLANKS

Steel gears, 8 inches in diameter by 2-inch face, are rough milled on the periphery and both sides, four at a time in 20 minutes, as in Fig. 10, using a gang of mills and the fixture shown.

This fixture has two spindles mounted so as to carry two gears blanks each, each spindle being run by a worm gear from the cross spindle *A*, which is run by a worm and gear, operated by the chain and sprocket *B*, connected to the regular feeding mechanism of the miller. In using this device the spindle and gear spindles are started, and then the miller table is fed upward until the small milling cutters have surfaced the blanks to the right diameter. After being rough milled in this way, the gears are removed and ground all over to exact size.

It is often extremely troublesome to repoint the tailstock center of a miller, owing to the fact that the point is not central with the body of the center; hence we made the cutter shown in Fig. 11, which is very simple and needs no explanation to those who have need for such a tool.

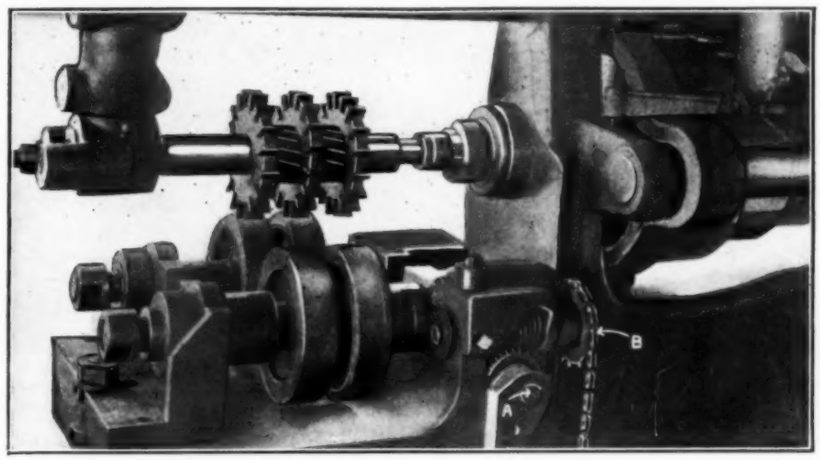


FIG. 10. STEEL GEAR-BLANK MILLING FIXTURE

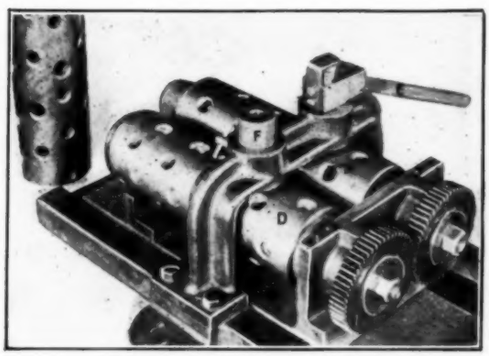


FIG. 6. JIG FOR DRILLING CAST-IRON BUSHINGS

FIG. 7. INDEXING JIG FOR WASHERS

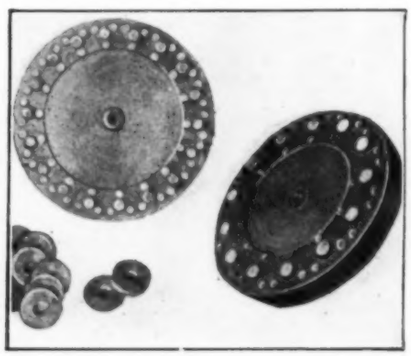


FIG. 8. FACEPLATE JIG FOR GRINDING WASHERS

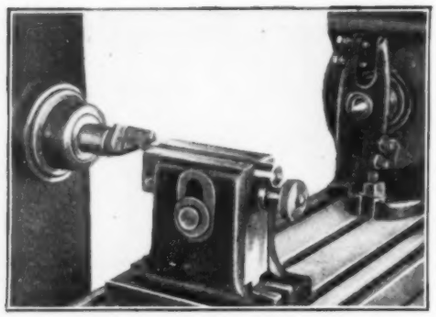


FIG. 11. TOOL FOR SHARPENING MILLER TAILSTOCK CENTER

FIG. 12. BRONZE NUT-BROACHING FIXTURE

BROACHING OUT BRONZE NUTS

Spiral grooves or threads are cut in bronze nuts like *A* and *B*, Fig. 12, with a broaching tool *C* set into the end of a large screw *D*, which runs in the upright bracket *E*, being operated by a large wrench. A novel feature of this fixture is that no threads are cut on the inside of the bracket *E* for the screw *D*, hardened pins *F*, *G*, *H* and *I*, together with four similar ones on the opposite side, into place through a blank and one hole punched, then the end of spring *C* is placed in this punched hole and the ring finished, using the holes at *D* and the pin *E* to space by. The center plug *B* is kept in place during the punching operations by the setscrew *F*, which engages the slot *G*.

Lathe centers of various sizes and tapers are placed in the regular grinder center head *A* and ground by using rings

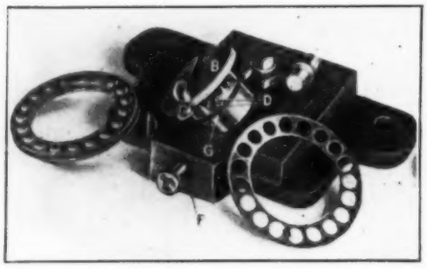


FIG. 13. DIE FOR PUNCHING BALL CAGES

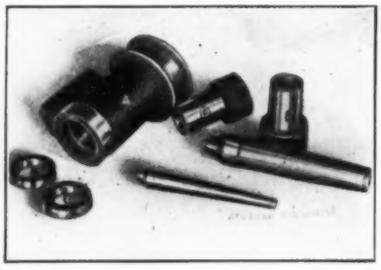


FIG. 14. BUSHINGS USED FOR GRINDING CENTERS

answering the purpose. The bronze nuts have a $\frac{5}{8}$-inch hole drilled and reamed in them previous to broaching, and the broach is $\frac{7}{8}$ inch outside diameter, one turn in two inches, double thread.

AN INDEXING DIE

Large ball retainer rings, like *A*, Fig. 13, of which only a few are made, are punched out for the balls in the indexing die shown. The center plug *B* is slipped like *B* and *C* in the front end of the spindle and long sliding steel bushings like *D* and *E* at the back end to accommodate the taper, which may be anything within the limit of the bushing.

LAYING OUT JIG PLATES

Our method of laying out jig plates is different from any I have seen elsewhere. Our jigs are mostly large ones and after the plate is planed up, strips like *A* and *B*, Fig. 15, are screwed on at right angles to each other. Then suppose I want to place a ½-inch bushing, 7 inches from the side and 9 inches from the end, I take a parallel *C*, which is exactly 6 inches long, and one *D*, exactly 8 inches long, and select a ground ring *E*, exactly 2 inches in diameter, which gives me the distances wanted, but the hole in the 2-inch disk is too large, so I fit into it two ground disks, *F* and *G*, in order to get the exact size hole I want, after which I clamp the disks securely in place and drill and ream the hole.

At *H* is shown a set of distance and thickness gages which, with a few standard-length bars or parallels, will give almost any length required, while at *I* are a set of hardened and ground disks of various diameters which are made to telescope into each other, so that any drill size may be obtained. With this outfit a cheap man can lay out jig plates as accurately and in far less time than the average toolmaker.

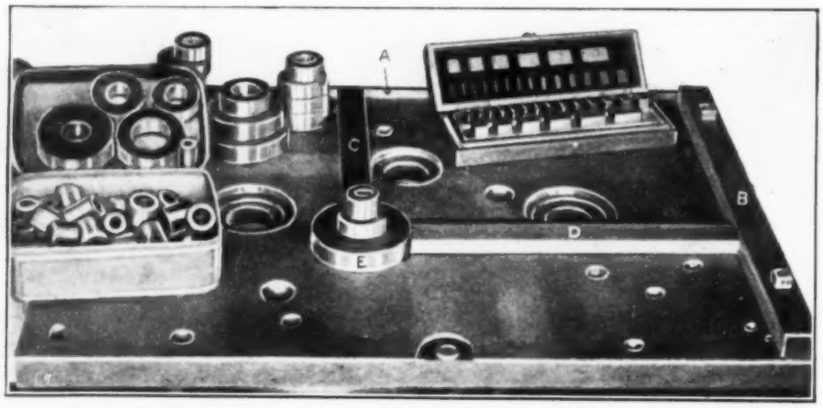
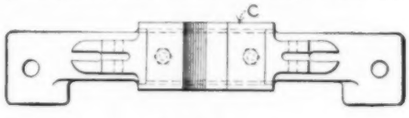


FIG. 15. BUSHINGS AND GAGES USED IN LAYING OUT JIG PLATES

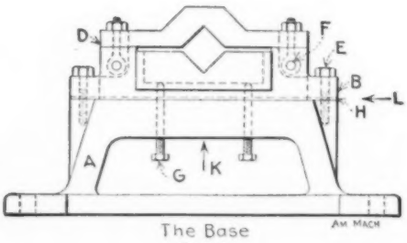
An Adjustable V-Block

BY A. J. DUDLEY

The fixture shown in the accompanying illustration was designed primarily for a boring machine having a fixed head and tailstock. This machine was used principally for boring differential housings for automobiles. The housings were unusually long and had scant stock allowance, thus requiring extreme care in centering up.



The V-Block
Fig. 2



The Base
Fig. 1

AN ADJUSTABLE V-BLOCK

In Fig. 1, *A* is a base which carries the V-block proper, *H* is a tongue on the base which fits into a groove in a sliding member *B* which slides or has an adjustment in the direction of the arrow *L*; it is secured by means of bolts *E*.

The V-block *C*, Fig. 2, is a machined casting which fits into the member *B* substantially as shown. This V-block has adjustment in the direction of the arrow *K* by means of screws *G*. Member *B* is cored to admit two eyebolts *F* which secure the strap *D* to the work.

A Northwestern Automobile Shop

By F. A. Stanley*

A Minnesota plant with many useful tools and methods.

An inserted-tooth cutter for milling aluminum crank cases and a grinding fixture for sharpening the cutter teeth.

A drill jig for brake cranks, a fixture for key-seating clutch spiders and a method of rounding gear teeth with a bench fixture.

Other handy tools, including a revolving die holder suitable for both right- and left-hand threads.

*Western editor.

One of the many interesting shops in Minneapolis, Minn., is that of the H. E. Wilcox Motor Car Company, builder of pleasure vehicles and auto trucks.

A number of views of this company's tools and methods, secured during a recent visit to the plant, are reproduced in the accompanying engravings.

An Inserted-tooth Cutter

Fig. 1 shows the method of milling aluminum crank cases with an inserted-tooth cutter which is designed to cut the metal freely and without liability of springing the work, or "hogging" in due to sudden increase or reduction of the area presented to the cutting teeth during the passage of the work under the cutter.

Fig. 2 illustrates the cutter head in detail, showing the form of the inserted tooth and the means adopted for binding the cutters in place. These are of round stock seated in holes that are finished to uniform depth so that the cutters, when ground to a common length and seated against the bottom of the pockets, will project the same distance from the center of the cutter head.

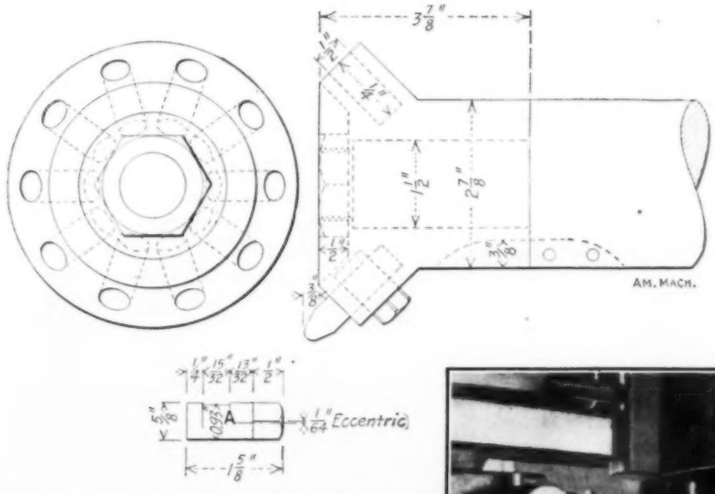


Fig. 2. Inserted-tooth Milling Cutter

The inserted teeth are clamped in position by an eccentric binder of the type illustrated in the detail at *A*, Fig. 2. This, when turned to grip the cutter, presses it back at the same time against its seat.

The round cutters have a pointed cutting end, well rounded off as shown, and the grinding fixture for giving them a uniform radius is illustrated in Fig. 3.

This fixture is placed on the table of the cutter and reamer grinder and the set of cutters are ground one at a time by clamping them in the chamber at the top of the fixture. The upper member is made to swivel upon the base and the cutter is swung to and fro past the wheel face by means of the nurled handle at the rear.

The cutter rests against an adjustable stop and is clamped by the same type of eccentric device as is used in the regular cutter head. The series of cutters are all roughed down in the grinding operation and then one after another are replaced in the fixture and the round end finished, bringing them to uniform length.

It is customary to keep at least six sets of cutter teeth sharpened and in readiness for use, and this is the equivalent practically of six cutters, as it takes but a few moments to change the inserted teeth in the cutter head.

An Adjustable Drill Jig

Two views are shown in Figs. 4 and 5 of a jig for drilling and reaming foot-brake levers or cranks of the form seen in Fig. 6. This jig has a right- and left-hand screw which operates jaws with V-openings in which the ends of the work are held and centered when the jaws are closed by the screw. There are two plates for the bushings and these are swung back to admit the work. Also, after the work is drilled, the jig is opened to allow reamers to be run into the drilled holes, and piloted facing tools to be fed down to finish the ends of the bosses around the holes. The opposite side of the work is faced after the work is removed from the jig, by resting the piece upon a suitable supporting fixture and again applying the piloted facing tool.

The long right- and left-hand screw for operating the jaws passes completely through the ends of the jig, as seen in Fig. 4, and carries two flanged nuts which fit between the forked ends of the blocks

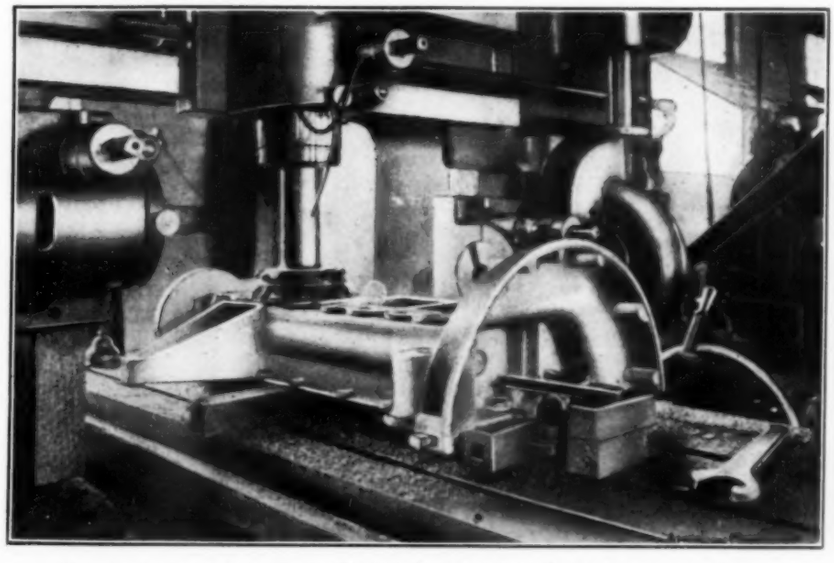


Fig. 1. Milling Aluminum Crank Cases with Inserted-tooth Cutter

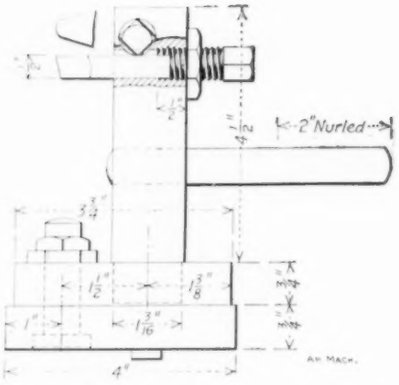


FIG. 3. GRINDING FIXTURE FOR INSERTED CUTTER TEETH

upon which the V-jaws are mounted. Inspection of Fig. 5 will show that provision is made for mounting two sets of V's on the main jaws, and by changing the false jaws and operating the closing screw, work of different lengths may be accommodated.

The necessary adjustment of the bushing carriers to correspond to the length of crank to be drilled is secured by the collars shown. A nurled and threaded

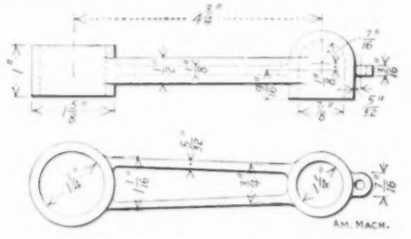
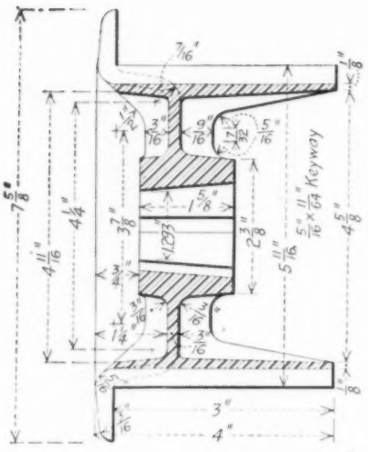


FIG. 6. BRAKE CRANK

extension collar between the two lids gives an accurate means of setting the bushings to the required center distance and the outer retaining collars may then be set up to hold the swinging plates against end motion, though still allowing them to be operated freely.



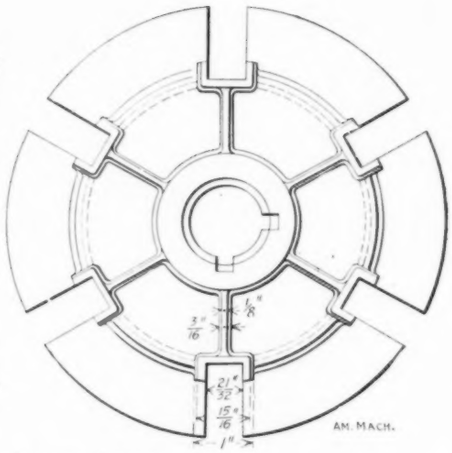


FIG. 7. CLUTCH SPIDER

KEYWAY FIXTURES

The multiple-disk clutch spider in Fig. 7 is slotted at six equidistant points about its circumference by indexing on the miller.

The two keyways through the bore of the spider must be at 90 degrees to each other and they are cut on the keyseating machine with the work held on the fixture illustrated in Figs. 8 and 9.

The former view shows the work in place on the fixture and the keyway tool in the bore. The bore is taper, 1½ inches per foot, and the hub *B* upon which it is located in the fixture has a corresponding taper. As the keyway has to be cut parallel to the side of the bore, the fixture is made with a sloping base which brings one side of the taper hole into vertical position when the job is set up on the keyseater table.

There are four locating pins *C* in the fixture and two of these are engaged by opposite slots in the sides of the spider. After one keyway is cut the spider is indexed by lifting it above the locating pins and turning it one-quarter way round to bring the same two slots over the next pair of pins.

These locating pins are flatted off on the inner faces for nearly half the diameter to clear the bottom of the slots milled in the spider.

THE KEYSEATING TOOL

The keyseating cutter passes through the clearance slot *D* in the fixure, Fig. 9. The cutter bar is shown in detail in Fig. 10. In Fig. 8 the cutter is represented in position in the bar, ready to cut on the down stroke.

Referring again to Fig. 10, the cutter *E* when in place is pivoted in the slot *F* where, owing to the oblong opening through which the pivoting stud passes, it has a limited amount of end movement.

It is normally forced upward by a spring so that the rounded surface under the forward end presses against the point of the feed screw, and the cutting edge is thus held outward in working position. After the cutter has been drawn down through the work and starts on its upward stroke, the oblong hole through

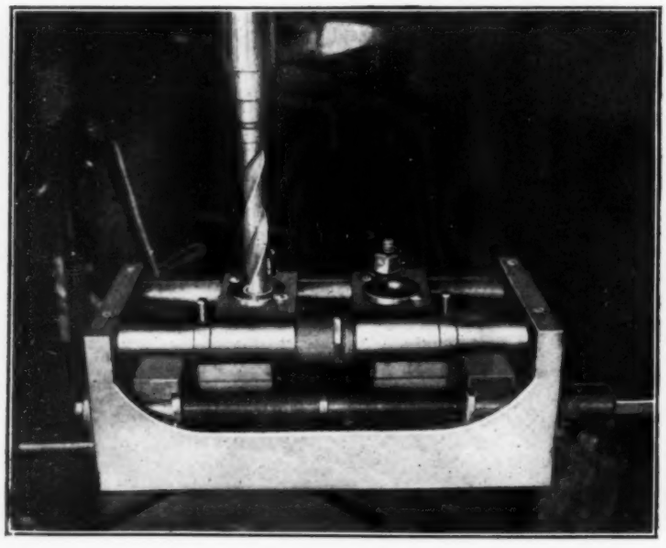
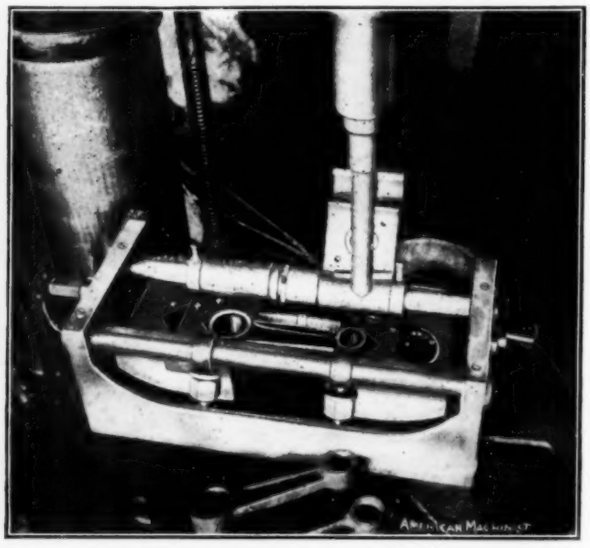


FIG. 4



JIG FOR DRILLING AND REAMING FOOT-BRAKE CRANKS FIG. 5

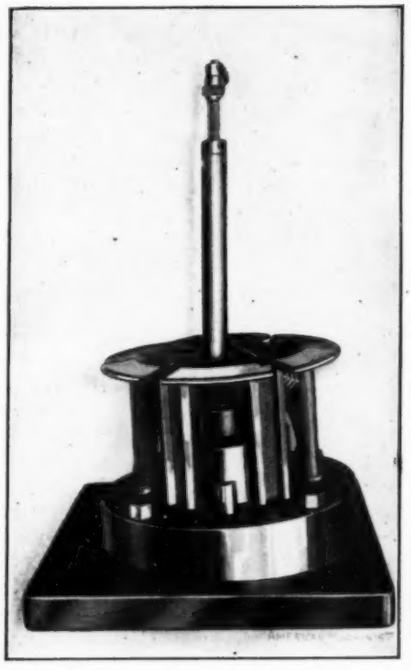


FIG. 8. KEYSEATING FIXTURE FOR CLUTCH SPIDERS

which the pivoted stud passes permits the cutter *E* to press backward and downward in its seat against its spring, thus preventing the cutting edge from bearing hard against the work.

The cone-pointed feed screw is given a slight turn before each down stroke of the cutter bar and the cutter is thus fed out for successive chips; at any position or depth of cut, however, it relieves itself upon the up stroke.

The feed screw is provided with two small nurled collar nuts (not shown) which are used as stops for regulating the depth of cut. They are locked at

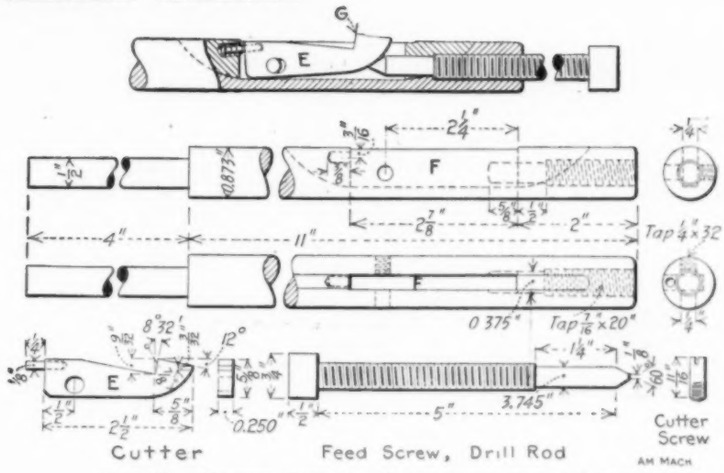


FIG. 10. CUTTER BAR FOR KEYSEATING CLUTCH SPIDERS

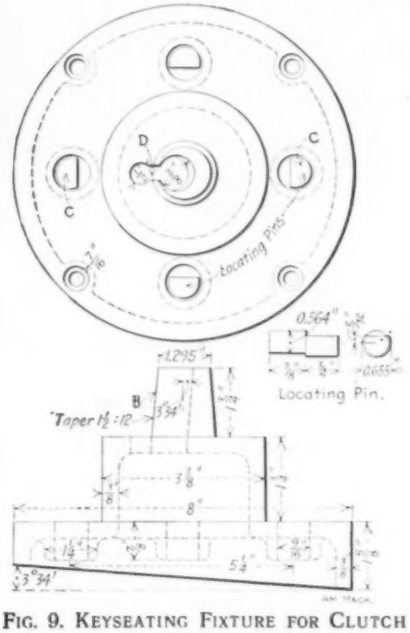


FIG. 9. KEYSEATING FIXTURE FOR CLUTCH SPIDERS

any position on the screw by using one collar as a jam nut.

A LATHE TOOL

The engraving, Fig. 11, shows a tool holder in the lathe for holding a half dozen tools for threading, turning, etc. The tools are carried in a head that can be indexed quickly from one position to another by operating the lever at the right, thus bringing one tool after another into action.

A GEAR CHIPPER

The bench device in Fig. 12 is for rounding the ends of gear teeth, and makes use of a chisel that is pushed down over the ends of the teeth by a long lever, a portion of which is visible in the halftone.

The head, which is rocked up and down by the long lever, carries a spring plug *A* which is notched to serve as an index pin for the gear, and a chisel *B* which is shaped to suit the round end

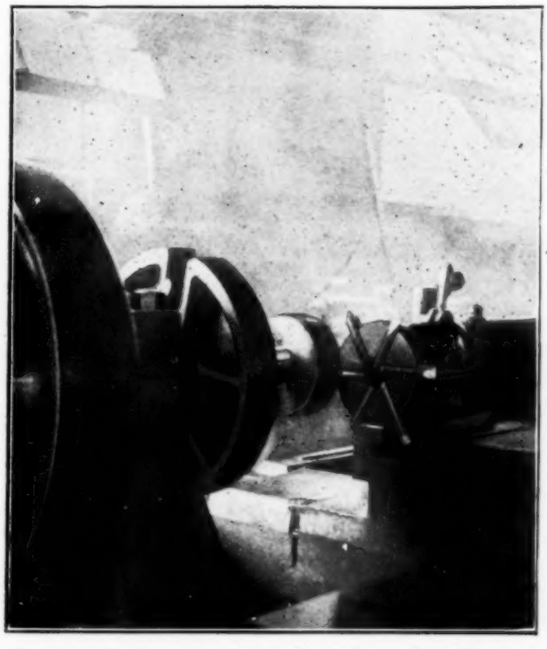


FIG. 11. AN INDEXING TOOL HOLDER FOR THE LATHE

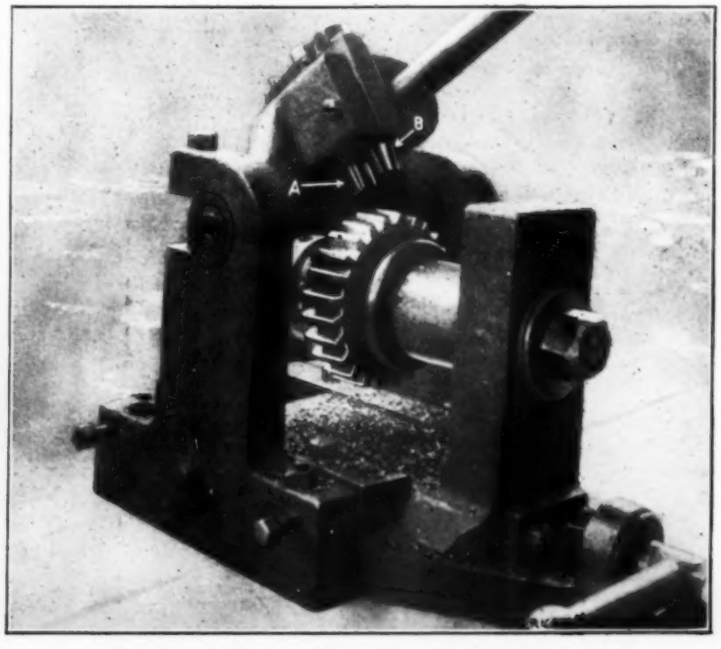


FIG. 12. A BENCH APPLIANCE FOR ROUNDING THE ENDS OF GEAR TEETH

required on the gear teeth. The gear is mounted on a stud in a sliding head which is operated by a screw and handle to feed the work to the rounding chisel.

Several strokes are made to round off each tooth, and the chips that do not break off at the root of the tooth are readily removed by touching up the work with a file. As a matter of fact, a hand chisel with a concave edge is applied at the outset at the roots of the teeth to form a slight undercut, which permits most of the chips to shear off smoothly under the action of the rounding chisel.

This device is operated easily and a 24-tooth 6-8-pitch gear may be completely rounded off in five minutes, including the finishing touch with the file.

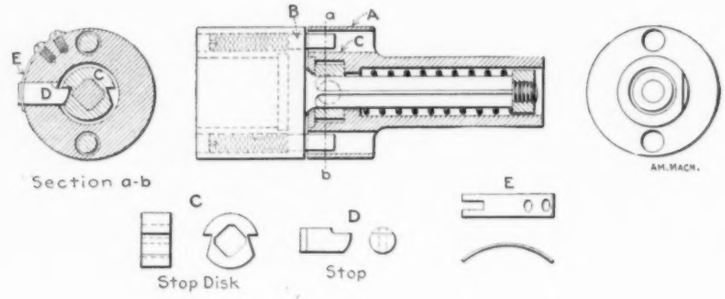


FIG. 13. A DIE HOLDER

DIE HOLDER

The die holder in Fig. 13 is of the revolving type with two driving pins which prevent rotation during the progress of the die over the work to the predetermined point. Upon the pins withdrawing from the holes in the die body *A* and the head *B* starting backward with the reverse of the work spindle, the notched disk *C* is engaged by spring plunger *D*, and die head *B* is then withdrawn from thework, the spring in the shank drawing the head back to its usual position as the die leaves the work.

The shank of the die head is squared, as shown in section, and a square hole is formed in disk *C* to fit the shank. The plunger *D* is pressed inward by flat spring *E* which is notched at the end to admit a tongue on the outer end of the plunger. When a left-hand thread is to be cut, the plunger is turned so that its toothed end faces the other way. This adjustment then permits the die head to rotate freely in a left-handed direction as soon as its driving pins are clear, but the moment the spindle reverses and starts forward, the stop disk *C* is engaged by the plunger *D* and the die then stops rotating and must withdraw from the left-hand thread.

The Manufacture of Horn Combs

By Ethan Viall*

Details of a great but little known industry; the way horn is treated and machined in making it into combs, and other particulars of mechanical interest.

Sharpening saws without removing from the arbor; milling with unhardened cutters; grinding spiral cutters; an eight-cutter comb-making machine and a novel straightening press.

*Associate editor.

Everyone uses a comb of some kind, whether of metal, rubber, composition, celluloid, shell or horn, and like most other things that are so common, few stop to even wonder how they are made. Only the principal mechanical operations through which the horn is routed to produce combs, as done in the factory of Noyes Comb Company, Binghamton, N. Y., will be described in this article, though these operations are very much alike for celluloid, shell or horn, the rubber or composition combs being molded and the metal ones made in various ways.

Horn, owing to the extensive dehorning of cattle, is becoming scarcer, and consequently higher in price each year, and contrary to general opinion cannot be picked up anywhere at any old price, a carload of first-class horns costing the manufacturer close to $5000, the present price ranging from $300 per ton up for steer horns and from $80 up for cow horns. The latter, along with bull horns are unsuitable for combs, owing to their being wrinkled, creased or having other faults, but steer horns, owing to their rapid growth, are the softest, smoothest, clearest, most flexible of all.

Only the middle part of a horn is used for combs, the tip being used for umbrella or cane handles or ornaments of various kinds, and the large, thin, open end for buttons or other small articles, but every scrap of the horn is used for some purpose, even the dust or shavings produced in working up the horn being saved and used for case hardening, chemical purposes or fertilizer.

DIVIDING AND SLITTING THE HORNS

The way a horn is sawed into three parts is shown in Fig. 1, the part *A* being used for combs and also, in a horn as large as this, the thicker part of the butt, the rest being used as previously mentioned. Special attention is called to the diagonal or spiral slit *B* sawed in the piece, which is made so that this section of horn may be flattened out into a sheet from which the combs are cut. This style of cut gives the combs a better "grain" and makes a better shaped piece than if the cut were merely made lengthwise, though the spiral cut requires much more skill on the operator's part.

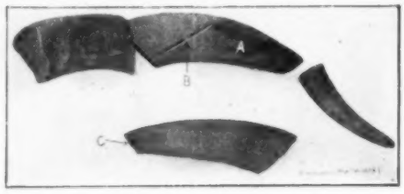


FIG. 1. THE WAY A HORN IS DIVIDED AND SLIT

The saws for dividing and slitting the horns are very similar to those used for sawing wood, and as a rule dull in a short time, owing not merely to the horn itself, but to the grit or other foreign substances imbedded in it, a piece of barbed wire being shown at *C* in the lower piece, into which the saw has cut.

GRINDING THE SAWS

Fig. 2 shows the type of saw used for dividing and slitting, and attention is called to the notches in the edge of the drive pulley at *A*. These notches are for use in indexing the saw-grinding machine, for owing to the tendency of the saws to dull quickly, one man's work averaging 1100 horns and three sharpenings a day, some means must be provided to sharpen them easily, which is done by an attachment fitting over the saw arbor, as shown in Fig. 3. In using the grinder the drive belt is run off and the attachment is slipped into place, the half bearing at *A* fitting over the saw arbor and the entire apparatus is steadied and held in place by the supports *B*. The grinder head is run by the belt *C* and is fed back and forth by the hand lever

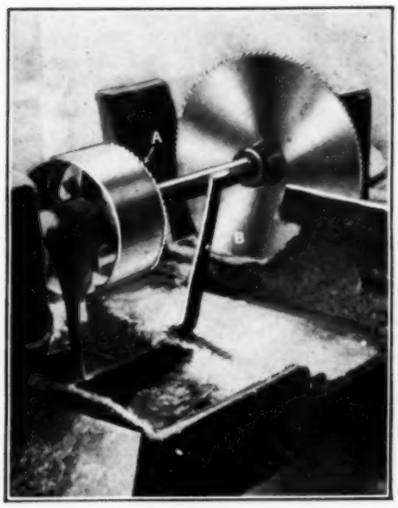


FIG. 2. DIVIDING AND SLITTING SAW

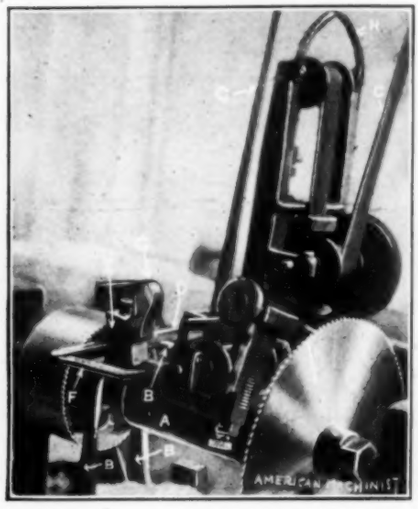


FIG. 3. THE SHARPENING ATTACHMENT.

D, which extends through and swings in the bracket *E*, being fastened to the grinding head by the connecting rod *F*. The bracket *E* also contains the indexing latch pressed into the notches in the edge of the pulley by the spring *G*. In grinding the saw, the reciprocating lever is worked with one hand and the saw indexed for each tooth with the other. The handle *H* is merely to afford a hold for the hoist hook.

HEATING AND FLATTENING

After the horn has been cut and slotted on the circular saw, the middle part used for the combs is placed in a large tank of boiling water, which cleans and heats it up to the temperature of the water, which prevents the radical cooling of the gas-heated kettle of paraffin oil, into which it is next placed and heated to about 350 degrees. This heating requires considerable care on the part of the operator, as too much heat or heat too long continued causes the horn to turn yellow and not enough heat makes the subsequent handling unsatisfactory.

As soon as the horn has been heated sufficiently, it is run between rolls, as shown in Fig. 4, and flattened out, though it springs back considerably as soon as released, the halftone showing a piece just as it drops from the rolls.

The next operation is to take each piece of hot horn as soon as it leaves the rolls and clamp it flat in one of the presses, shown in Fig. 5, the clamps or presses being set on the ends of the spokes of a cast-iron, six-armed spider, which revolves on a spindle, and is set into a tank of constantly changing cold water. As each piece is clamped, the spider is turned one-sixth of a turn to the right, a cooled piece taken out of the left-hand press, and a hot piece put in the spider, turned again, and so on, the pressing of the hot pieces and the cooling in water giving the horn a set that keeps it flat like a sheet of pasteboard, the pieces looking like *A* and *B* in Fig. 6, which represent the right and left sections of a pair of horns.

FIG. 4. ROLLING OUT THE SLIT HORNS

FIG. 5. THE FLATTENING AND COOLING PRESS

SAWING INTO STRIPS

The next step is to cut the sheets into strips to the best advantage, according to the judgment of the operator, which is done with a saw as shown, the adjustable parallel width guide being worth noticing. Parts *C* and *D* swivel on pins *E* and *F*, being connected by rod *G*. Part *C* is made so as to be indexed for about one-third of a turn by means of latch pin and lever *H* and holes *I* in the edge of the plate. As can be readily seen, changing the angle of parts *C* and *D* changes the distance between the edge of guide *J* and the saw, yet keeps it parallel, so that strips with parallel edges are easily cut of almost any width.

TRIMMING THE EDGES

After being cut into strips the ends are trimmed as in Fig. 7, *A* being a sliding carriage, *B* the handle by which it is operated with the right hand, while the left holds the strip of horn down on one of the stepped stops at *C* or *D*, the particular stop used depending on the length of the strip being trimmed, as the piece

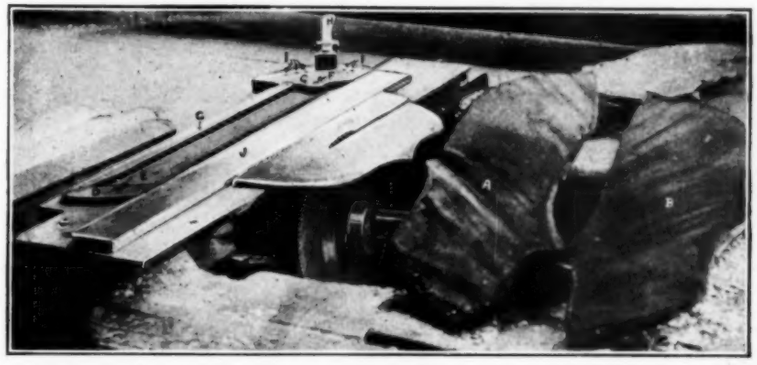


FIG. 6. STRIP-CUTTING MACHINE

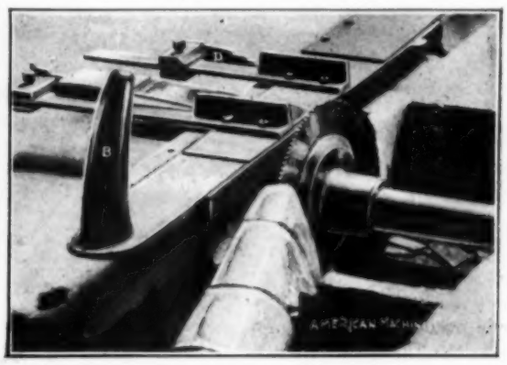


FIG. 7. END TRIMMER

FIG. 8. SMOOTHING INSIDE SURFACE

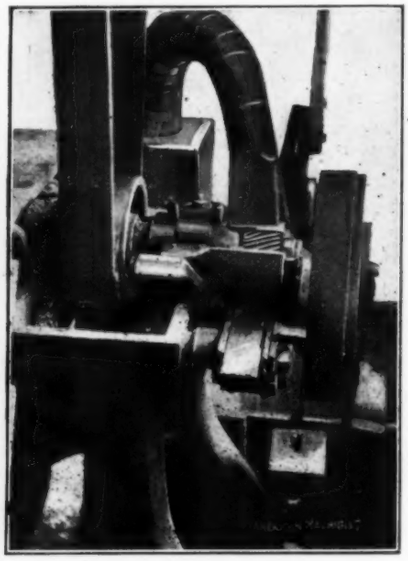


FIG. 9. SIZING STRIPS

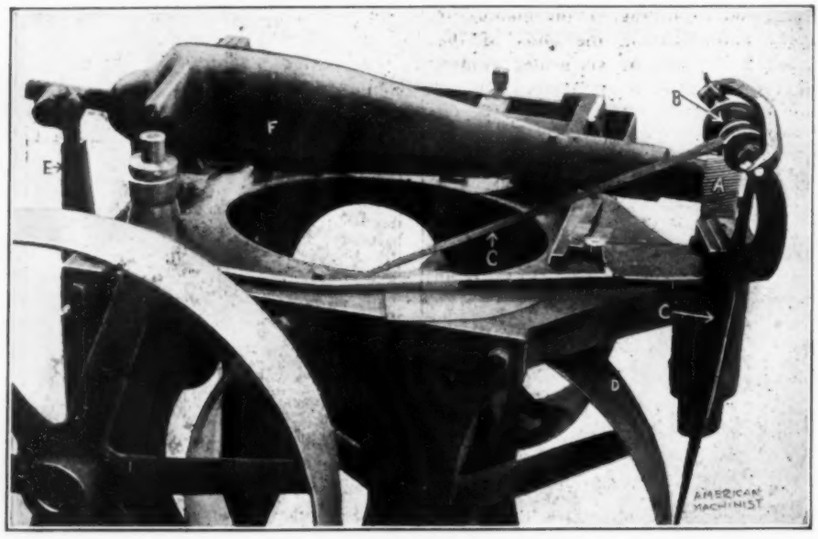


FIG. 10. SPECIAL SPIRAL CUTTER GRINDER

FINISHING THE BLANK

is shortened as little as possible.

Next the inside of the strip is scoured by hand on wooden wheels covered with sandpaper, as shown in Fig. 8, after which they are milled or planed to exact thickness in the special machine shown in Fig. 9, the cut being taken from the outside of the strips, after which they are sorted according to sizes, placed on edge in shallow wooden trays holding about twelve dozen each, and stored in a drying room to season, the best grade being allowed to season about three months.

UNHARDENED CUTTERS AND THE GRINDER USED

A peculiar thing about the surfacing off of these strips of horn is that a hardened cutter will not work satisfactorily as it chatters and makes rough work, the cutters used being of unhardened high-speed steel, which are sharpened in the special grinder, Fig. 10. This grinder is made to automatically index and give the necessary spiral motion to the cutter, placed at *A*, as it feeds under the carborundum grinding wheel *B*, which is driven by belt *C* from the pulley *D*. The feeding motion of the ram carrying the cutter, is given it by the rocker arm *E*, the spiral cam and indexing mechanism being contained in the sleeve *F*.

HYDRAULIC PRESSING

Molded and translucent effects are given the sized strips of horn by pressing them in between dies in a hydraulic press, Fig. 11 showing the press with most of the horn strips finished and partly pushed out of the dies. The pressure applied by the press is 3000 pounds per square inch, the pieces of horn being heated to about 325 degrees by a steam jacket which carries steam at about 100 pounds pressure, the dies, of course, being made so as to close only a certain distance, as otherwise the horn would be pressed out like paper.

The pressure and heat cause the strips to warp or curl as they leave the dies and to remedy this the hot pieces are laid between boards in the press, shown in Fig. 12, the hot strips being put in at the bottom by means of an ingenious foot-lever arrangement, which method gives the pressure of the entire weight of the parts above on the hot strips of comb. As the hot pieces are put in at the bottom the cool ones together with the mold boards, drop off of the top into the box *A* which, when full, is lowered and emptied into box *B*, where the pieces are easily removed.

CUTTING THE TEETH

The most interesting machines in the entire shop are the comb-cutting machines, one of which is shown in Fig. 13 and which is capable of turning out an average of 325 dozen combs per day. Without going into a detailed description

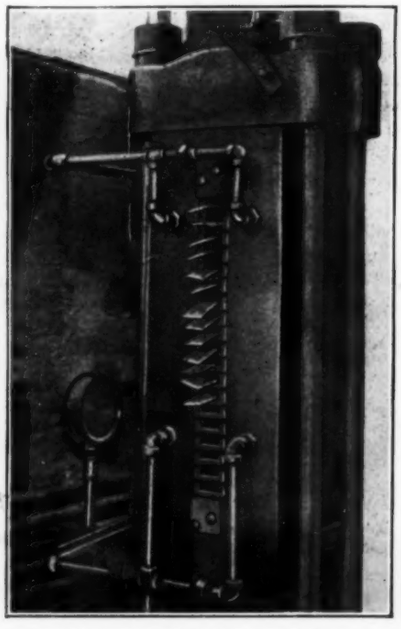


FIG. 11. HYDRAULIC PRESS

FIG. 12. STRAIGHTENING PRESS

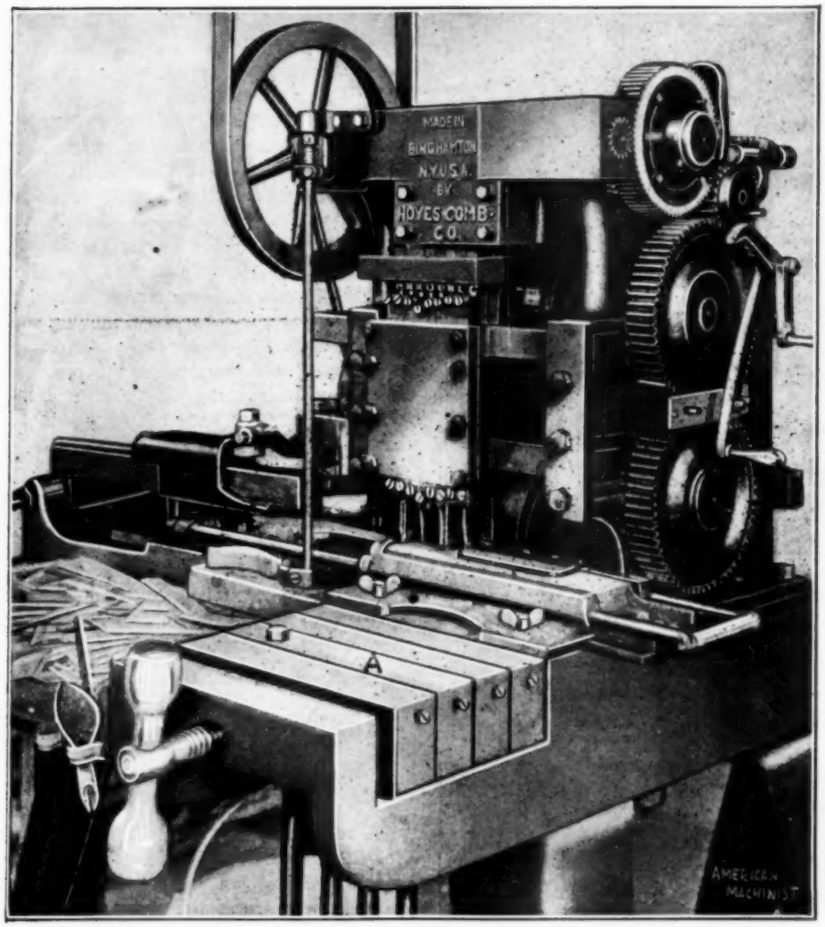


FIG. 13. AUTOMATIC COMB-CUTTING MACHINE

of this machine, it will be seen that there are eight plungers, each carrying a cutter at its lower end, which cut the teeth, two combs being cut at a time. The cutters are: 1, cutter for cropping of the end of the piece of horn; 2, cutter for diagonal cut of guard tooth; 3, first of a pair for cutting coarse teeth; 4, second of the same pair for forming shape of tooth; 5, first of a pair for fine teeth; 6, second of same pair; 7, cutter for cutting off the cropping on fine end, and 8, cutter for diagonal cut of fine guard tooth. These eight cutters work in turn as the comb blank is fed under them, finishing the teeth of the two combs at one pass, the parts looking as shown in Fig. 14, the two upper pairs being pulled slightly apart, so as to show better, though as they come from the machine they fit closely together. In the lower pair the teeth are cut in the form of a curve, a profile device making this possible. Of this last pair, the narrow-backed one is used for the metal-backed type, the other being intended for a barber's comb.

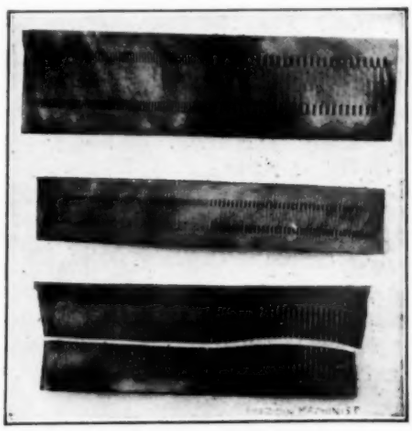


FIG. 14. PAIRS OF CUT COMBS

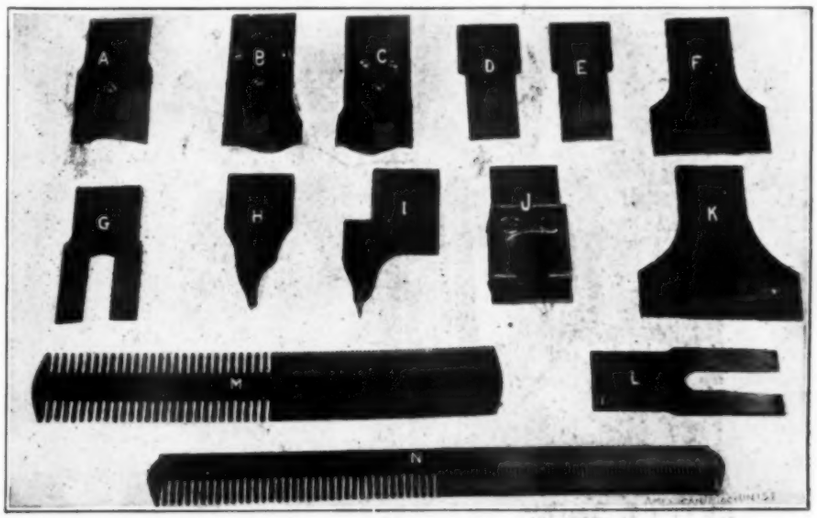


FIG. 15. CUTTERS USED IN AUTOMATIC COMB-CUTTING MACHINE

TYPES OF TOOTH CUTTERS

Some of the cutters used are shown in Fig. 15, *A*, *B* and *C* being for forming the end teeth, *B* and *C* being a pair; *D* and *E* are a pair of straight-tooth cutters; *F* and *K* are end cutters; *G* and *L* are used for cutting teeth in a comb like *M*; *H* and *I* are for making cross cuts, while *J* shows a cutter with a stripper attached. Although not perceptible in the halftone, the tooth cutters have a little L-shaped corner on the cutting end which cuts partly around the end of the tooth, so that the next cut made by the other one of the pair of cutters will meet it and the two combs thus formed are easily pulled apart as they come from the machine.

Referring back to the machine shown in Fig. 13, it will be noticed that there are a set of heaters at *A* which are heated by steam under 100 pounds pressure and the comb blanks are clamped in these, previous to cutting, the heat softening the horn, making it easy to cut without readily breaking it or damaging the thin cutters. Softened in this way the machine will cut 3000 dozen combs before the cutters have to be reground.

A HAND-OPERATED MACHINE

A contrast to the automatic machine just shown is the hand machine, Fig. 16, designed and built by the grandfather of the present owners of the factory more than eighty years ago. Originally there was a ratchet feed for the comb on this machine, but it has become lost or misplaced, but at *A* and *B* are shown the holders for the pair of cutters used, which were alternately brought into cutting position by swinging the pointer *C* back and forth as the hand lever was worked.

Previous to the invention of this machine, and even now in the West Indies,

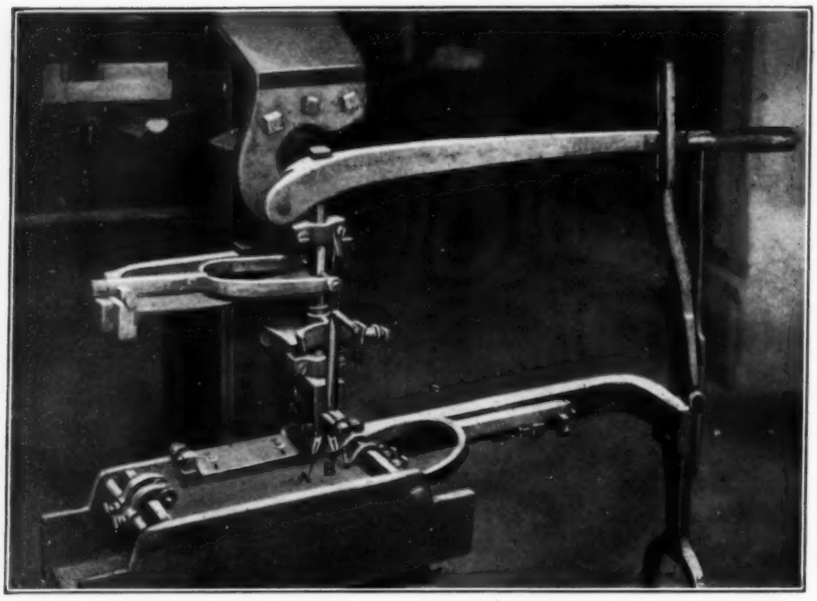


FIG. 16. OLD HAND-OPERATED COMB CUTTER

combs were made by hand, the teeth being cut with a small saw, which, of course, wasted considerable material.

PRESSING MACHINE

While soft and warm, the horn has a tendency to distort and so the cut combs, as soon as they come from the machine, must be pressed until cold, and this is done in the machine shown in Fig. 17. One of these machines stands close to the comb cutters so that one operator easily keeps both machines busy. The soft comb is slipped in between the hardwood blocks from the front of the machine just over the box *A*, a cold one being taken out to make room for it. As soon as the soft comb has been placed on top of the bottom block the handle *B* is pressed, the gear *C* revolves, moving connecting rods like *D* on each side of the machine; this rocks the two levers *E* and *F* downward causing dogs, as at *G*, to catch the beveled ends of the block and carry it upward, forcing the entire circle of blocks around the rings a distance equal to the combined thickness of one block and comb, the machine stopping automatically at the bottom of the stroke. These rings are five feet in diameter and will hold about 25 dozen combs, which gives them ample time to cool and get set before they are taken out.

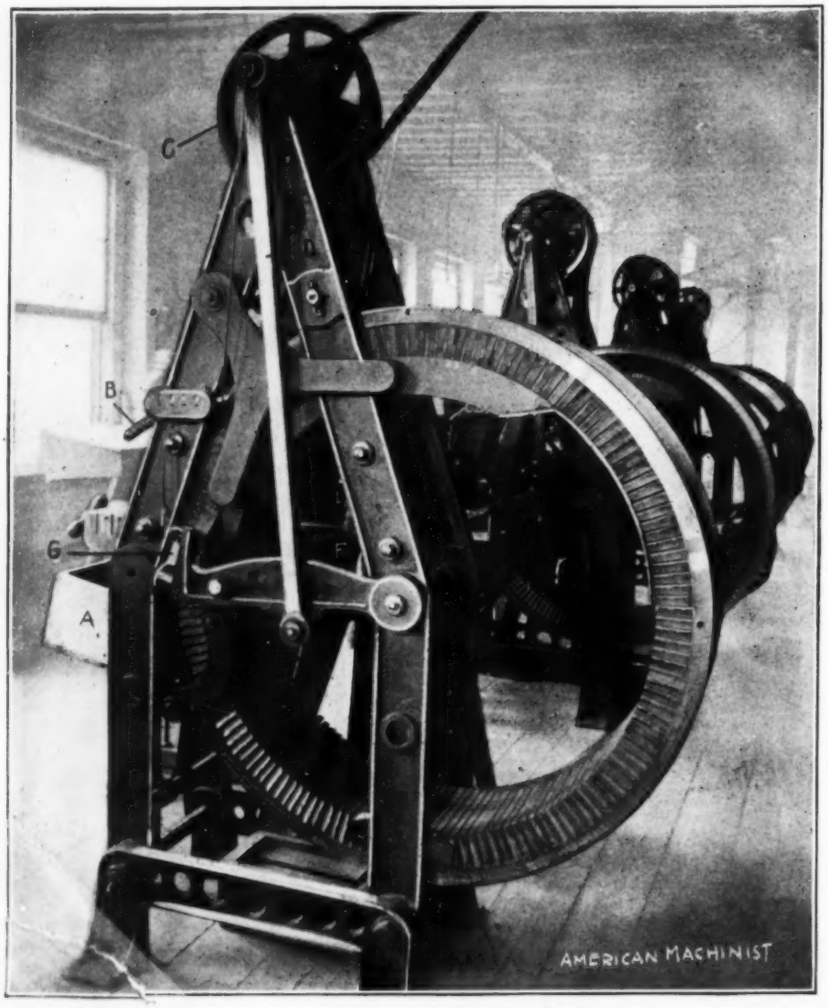


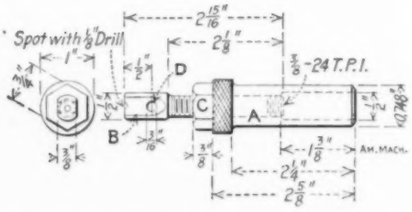
FIG. 17. COMB-COOLING PRESS

Adjustable Stop for Automatic Screw Machine

BY D. A. CARR

A very simple form of adjustable stop for the Brown & Sharpe automatic screw machine is shown herewith, which has proved to be very satisfactory in practice.

It consists of a machine-steel pack-hardened holder *A*, made to fit the hole in the turret. The stop proper *B* screws into this holder, and can be adjusted back and forth by either turning with a wrench or by a pin placed in the hole



ADJUSTABLE STOP FOR AUTOMATIC SCREW MACHINE

D. Check nut *C* holds *B* securely in position after adjusting.

The end of *B* is spotted with a 1/16 drill to form a recess for the teat formed on the end of the work when cutting off.

This particular stop is made for the No. 0 machine, but the same idea with the dimensions changed to suit, is applicable to all sizes.

The total value of motors of all kinds, including supplies and parts, manufactured increased from $19,505,000 in 1899 to $22,371,000 in 1904, and $32,087,000 in 1909, or 64 per cent. for the decade.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Assembling Die for Lamp Dome Supports

The use of press tools for assembling operations is becoming better appreciated each day, and there are many operations now performed in this way which were formerly done by hand, and the parts of an oil lamp for carriage use shown at *A*, Fig. 1, are samples of this class of work. The two pieces are assembled by inserting the four uprights through slots punched in the large piece, after which the sides of the posts are bent around at right angles to the outer portion, as shown, forming a channel section to make them more rigid for the better support of the dome of the lamp, and also to fasten the two parts together.

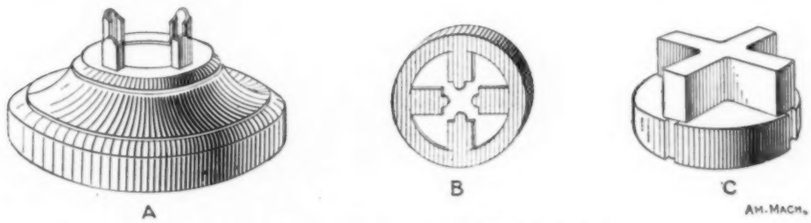


FIG. 1. LAMP PARTS AND A BENDING FORM

The method of punching out the part embodying the posts is shown at *B*, and after being blanked out the four pieces that are to form the posts, are bent at right angles to the ring and assembled by hand in the dome, and are then placed over the form *C* to be finish bent. This form *C* is set into the cast-iron base of the die block *D*, Fig. 2, and is fastened to it by screws from below, and it will be noted that there are four vertical grooves in the form which are used to locate the rounded ends of the posts.

After being set in position on the form, the parts are bent as shown at *A*, in Fig. 1, by the action of the slides *E*, which operate in ways milled in the base and are kept pressed outward by the spring plungers *F*. The heads of these plungers are grooved to prevent them becoming air bound, and the slides *E* are oil grooved on top and bottom to distribute the lubricant. Soft-steel plates *G* are screwed and doweled to the base and retain the slides in their grooves in addition to forming a cradle for the work.

Eight steel blocks *H* are attached to the base and between these blocks rock the actuating levers *I*, which carry hardened tool-steel rollers at each end.

The upper part of the die comprises a four-armed wedge member *J* of hardened steel, which is bored out to receive the pressure plunger *K*, which is pressed downward by the heavy helical spring *L* and limited in travel by the shouldered screw *M*. Vent holes are drilled in *J* to permit the air to escape above the plunger *K*.

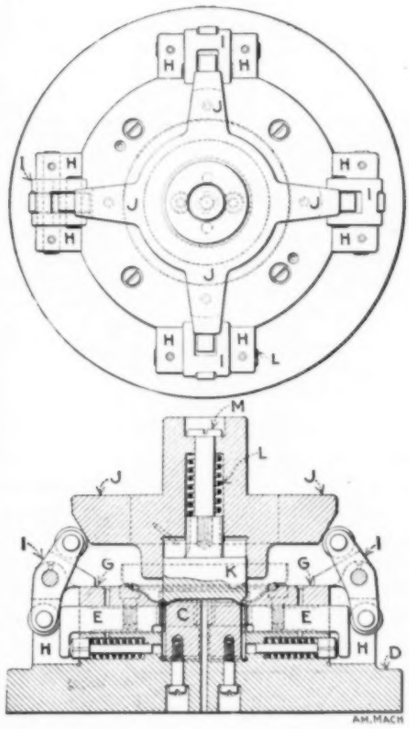


FIG. 2. DETAILS OF ASSEMBLING DIE

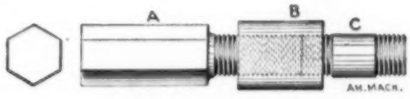
The descent of the upper member first holds the two lamp parts securely while the slides of the die are forced in, forming the posts over the block *C* by bending them around the cross portions.

This tool is used in an ordinary press and requires a stroke sufficient, of course, to enable the work to be entered and removed quickly.

Detroit, Mich. ARON LAWRENCE.

Nipple Holder

The accompanying cut shows a first-class pipe nipple holder which was suggested and made by a machinist here. The drawing shows a ¾-inch holder and



A NIPPLE HOLDER

is composed of the following parts: *A* is a piece of hexagon machine steel which is threaded ¾-inch pipe thread on one end to receive the sleeve *B*. The pipe nipple *C* to be threaded is screwed by hand to end of sleeve *B* until it bottoms at end of piece *A*. When the thread is cut on the nipple sleeve *B* is unscrewed about one turn and the nipple can then be taken out by hand. The hexagon end of piece *A* is held in the pipe vise or in a chuck when a power machine is used. Anyone wanting nipple holders that will hold and do no damage to the thread will make no mistake in making up a full set of this style. CHARLES MARKEL.

Shop Foreman, C. & N. W. Ry., Clinton, Iowa.

Improvement on Double Spindle Centering Machine

For several years I have used a double-spindle centering machine, but lately, on experiencing a little difficulty with it, I added a special attachment.

The apparatus works very satisfactorily. Fig. 1 shows the front elevation, the sectional plan, and side views of the centering machine. The construction and the working of the machine are, of course, well known to the machinist.

When the swing arm is shifted to the position shown at *M M'*, the center drill *D* is set at the center of the work and the swing arm *N N'* is shifted in the other direction from the center line; then the reamer *R* is ready for work. During the operation of centering, the swing arm

is kept in its position by pressing the lower part of the arm to the stop pin, where it is placed in the proper position in the machine. The machine has no positive stop and the above operation is done simply by pulling the handle *T* by hand. Hence, sometimes there occurs a vibration in the arm, due to the resistance of the work. The result is that the drill or reamer is shifted out of its position. To remedy this defect, I designed an automatic positive stop for the shifting arm *E*.

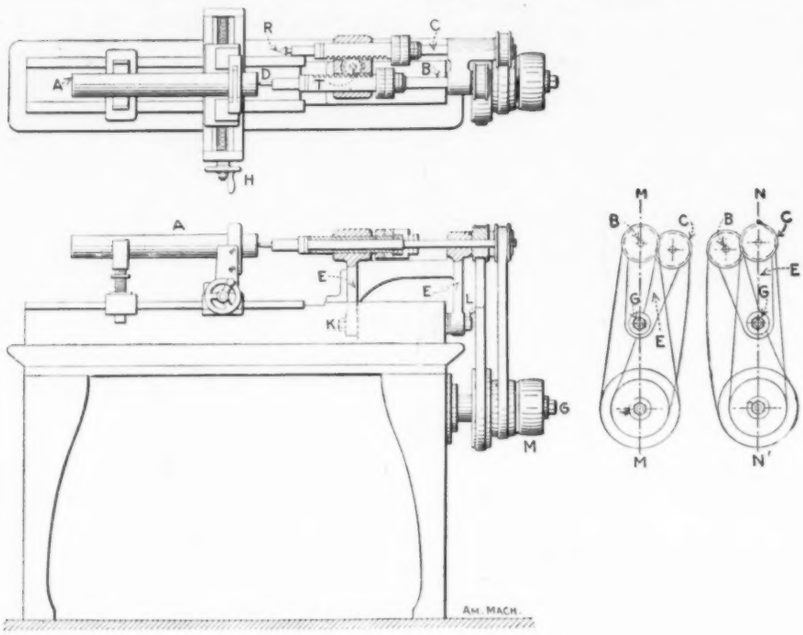


FIG. 1. THE CENTERING MACHINE

Figs. 2 and 3 show the improved apparatus for the positive stop. The supporting block *W* is fixed to the right end of the machine. The spindle *V* has a coil spring between its collar and the left bearing of *W*. The spindle *V* can move freely in the direction of its longitudinal axis. The plate *P* is fixed to the inner surface of *E* and has two conical holes *B* and *H*, each of which is made to fit to the point of the spindle. The plate *P* has an elevated part *F*. The loose collar *G* turns freely on its center but cannot move along its axis. The centers of the two small holes *B* and *E* are placed so as to correspond to the positions of the swing arm.

When the swing arm is in the position shown in the front elevation, Fig. 2, the end of the spindle *B* fits to the hole, and firmly stops the arm in this position. The center drilling is done by feeding the drill. After this has been done, the swing arm is shifted for center reaming.

In Fig. 3 *E* is pulled by hand in the direction shown by the arrow and during this operation *F* comes in contact with *G* and presses back *V* to the left, so that the spindle *A* is drawn out from the hole *B*; as *E* moves to the front *F* passes over *G* and the point of the spindle *A* meets the hole *H*. Then *A* is pressed into the hole *H* by the tension of the spring *S* and the position of the swing arm *E* is firmly fixed. In this position the center reamer just comes to the center of the work and the machine is ready for reaming.

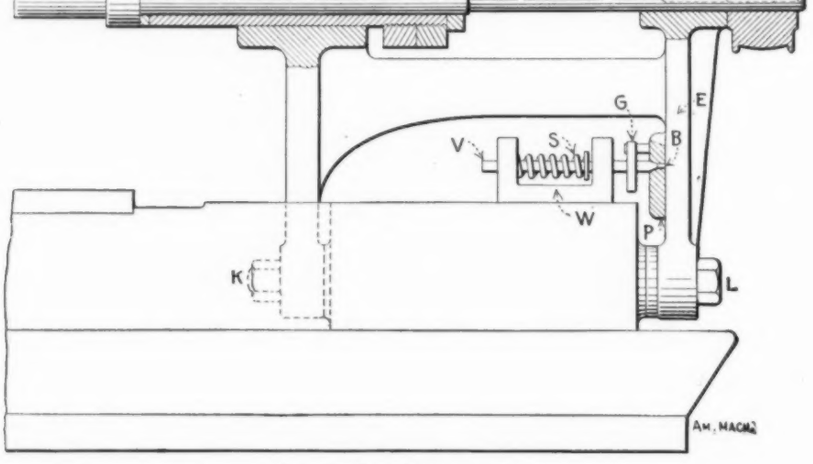


FIG. 2. THE IMPROVEMENT

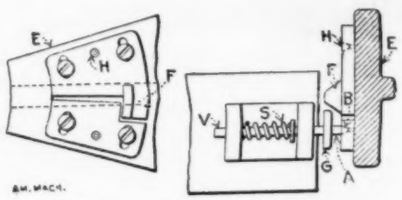


FIG. 3. ADJUSTMENT FOR REAMING

It is very easy to adjust the center distance of the holes when it is necessary.

Tokio, Japan. Y. SEKIGUCHI.

Estimating or Guessing?

The manager wrote a letter to a builder of heavy-duty turret lathes for information as to what the machine would do in the way of reducing the cost of building of gas engines in sizes from four to 40 horsepower.

In response they sent an expert estimator to go over our work. It fell to my lot to take him around the plant and get his estimates on the various pieces his machine would handle.

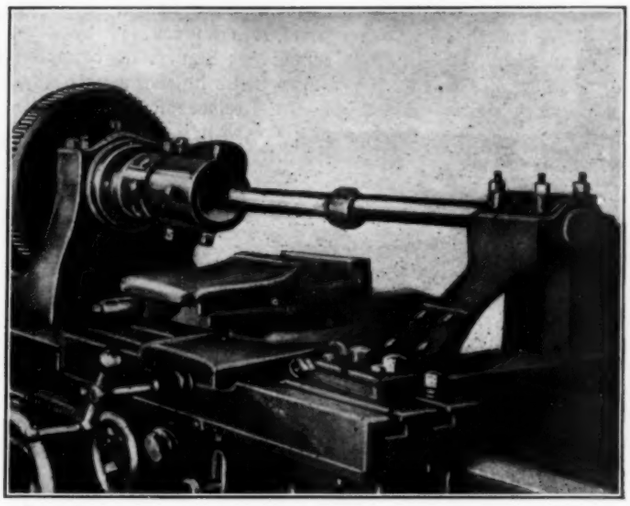
After showing him three or four pieces, I noticed his method to get the time was to cut the engine-lathe time in two or thereabouts, so I decided I would forget the time on all these pieces I was supplying him with and let him figure from the piece, just giving him the details of accuracy and finish required. His time from that on varied considerably from half the engine-lathe time, as I knew it. Invariably his time was high, in most cases little or no better than we were doing with our own equipment.

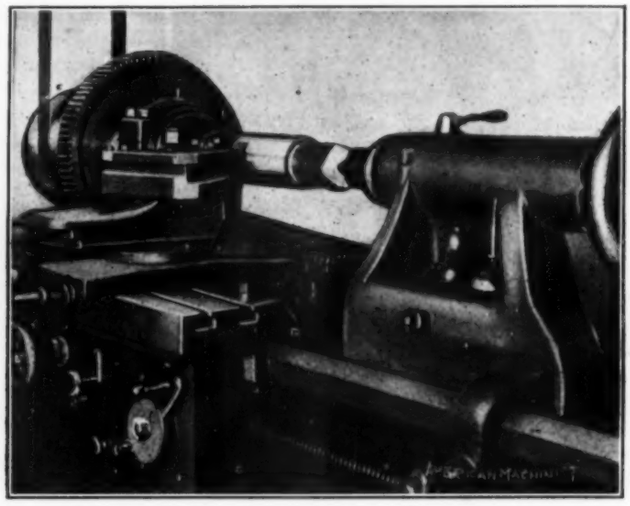
One job in particular was amusing; it was gray-iron pulley bushings, 3¼x4¼x 16 inches, accurate to size, with a smooth finish inside and out.

Mr. Estimator sized the job up, thought over it for a while, and finally came to the conclusion he could do them in an average of one hour apiece all over.

I then informed him we were doing them in 25 minutes each on a regular engine lathe; he refused to believe this statement until I piloted him directly to the cost keeper's desk and asked for the records, which showed an average monthly time of 28 minutes each.

He intimated that he was from Missouri, and as we were boring bushings at the time I took him to the machine and let him see the operations for himself, which were like this.





FIGS. 1 AND 2. BORING AND TURNING PULLEY BUSHINGS

A boy was just dropping one into a special chuck (shown in Fig. 1) as we arrived, he then tightened 10 setscrews that set the bushing in position. The next move was to push a double-ended flat roughing cutter through a slot in the boring bar and drop in a taper pin to hold it in place, start up the lathe with a $\frac{1}{8}$-inch feed and rest for three minutes. When the cutter came out at the other end, he backed the bar out by hand, removed the roughing cutter with his fingers and inserted in its place a single-end tool held in the same way; this tool is used to cut the oil groove and is fed through by hand with the lathe in motion at a lead of about 4 inches per revolution, and then fed back again in the same manner. That tool is then removed and a floating cutter put in its

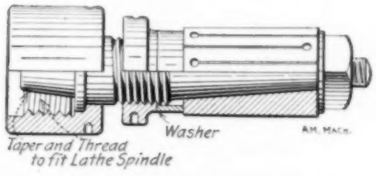


FIG. 3. EXPANDING MANDREL FOR PULLEY BUSHINGS

place, which is fed through with a $\frac{1}{4}$-inch feed; the rate of feed is changed by simply pulling a lever. When this cutter is removed the job is done, and with this particular bushing the time consumed was 10 minutes.

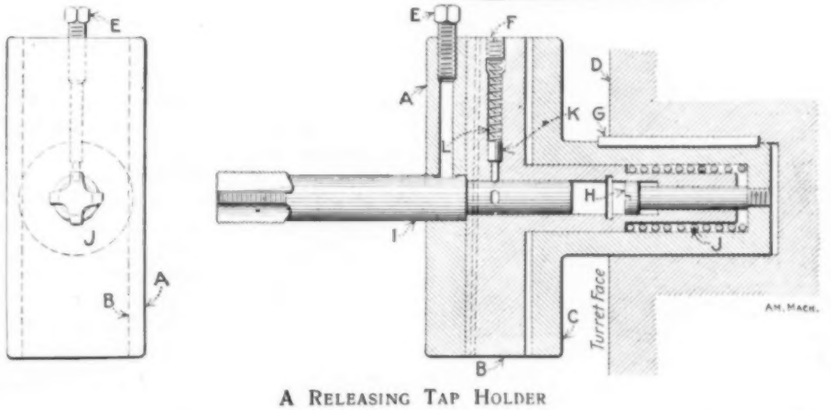
They are turned on the expanding mandrel, shown in Figs. 2 and 3. It screws onto the nose of the spindle and is supported on the other end by the tail center.

The bushings are put on and removed with a nut. The tool post is of the turret type, with the finishing cutter set to correspond with the roughing cutter, which in turn is set to size by running against a stop on the lathe carriage. The finishing cutter has an individual fine adjustment that allows for getting the exact size, and by taking two cuts they can be put on the mandrel turned and removed, without any fuss or flurry, in 15 minutes, making a total time of 25 minutes for a finished bushing.

Oil City, Penn. J. B. RAY.

A Releasing Tap Holder

This tap holder is designed mostly for automatics, but with a few changes in design can be made to give good results on any make of machine. The main body *C* is machine steel, with a shank turned on one end to fit the hole in the turret.



A RELEASING TAP HOLDER

It is kept from turning around in the hole by the key *G*.

A hole is drilled in the body *C* to receive the driving jaw *B* and compression spring *J*. There is also a tapped hole in the end to receive the stop screw *H*. The part of *C* shown cut out is to receive the part *B*, which should be a nice sliding fit. The part *B* also has a hole drilled in it to receive the shank of the tap, and also a hole to receive the stop screw *H*. Holes are also drilled in *B* to receive the pin *K*, spring *L* and screw *F*.

The part *B* is made of machine steel. It drives the jaw *A*, also made of machine steel. The jaw *A* is held firmly on the tap shank *I* by means of the setscrew *E*.

When the holder is not working everything is locked as shown in the partial plan view. As the turret comes up and the tap strikes the work it compresses the spring *J* until the tap takes hold. The tap is kept from turning by the pin *K*.

Just before the tap gets to the bottom of the thread, the turret starts on its return motion. The machine should be set so that if the thread goes to the bottom of a hole, the part *A* will leave the part *B* by the time the tap strikes the bottom. If this is done the part *A* leaves *B* and revolves with the tap, and part *A* can be used to take the tap out of the work. The part *B* can only come out as far as the stop screw. The pin *K* is also used to keep the part *A* from coming off until the time required. If the tap hole goes clear through the work it makes no difference as everything depends on the setting of the turret.

HAROLD E. MURPHY.

Westerly, R. I.

Binding the American Machinist

If one can afford it, there is no question as to the best method of binding magazines, and that is to have the work done by a professional bookbinder. For many this method seems too costly and a cheaper substitute is desirable. For a number of years I have used a method similar in some respects to that described by F. D. Buffum, Volume 35, page 265.

For current numbers I use a transfer case having a hinged back, the case being large enough to hold one volume. The closed case presents a neat appearance on the shelf and makes the unbound magazines easily accessible, it being possible to select any issue by the date on its back and to remove and replace it without disturbing the others.

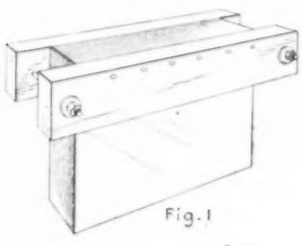


Fig. 1

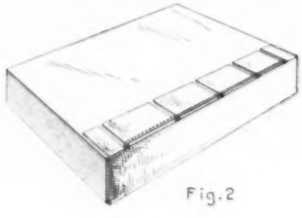


Fig. 2

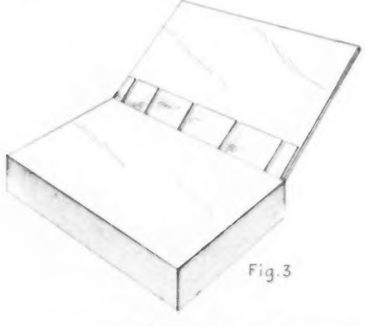


Fig. 3

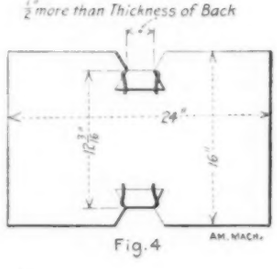


Fig. 4

BINDING THE AMERICAN MACHINIST

In preparing a volume for binding, I remove the advertising pages, arrange the magazines in proper order, with the index in front, place a folio of advertising pages at the front and another at the back, and clamp the whole in a drilling jig, as shown in Fig. 1. This jig consists of two pieces of hard pine 1x4x16 inches, having a ⅜-inch bolt in each end and having ⅛-inch holes spaced 2 inches apart, ¼ inch from the edge. The volume of magazines to be bound is clamped very tightly in the jig and holes are drilled through them with a ⅛-inch twist drill. I use a carpenter's brace for this purpose, but a drill press would be better if available. After being drilled, the volume is removed from the jig and strong twine is sewed through the holes with a tape needle and securely tied.

A piece of strong cotton cloth, ½ inch shorter and three inches wider than the back is slitted deep enough so that the unslitted portion is the width of the back. The back is then well daubed with hot glue and the cloth drawn under the twine, as shown in Fig. 2. A piece of pasteboard is then glued to the cloth on each side of the volume, see Fig. 3. The volume is then put in a press or under weights and allowed to dry.

The last step is applying the outside cover, which is made as follows: A tracing is made, having on it the name of the magazine and any other lettering desired. For the AMERICAN MACHINIST the dimensions of this tracing should be 16x24 inches. From this tracing as many cloth blueprints are made as there are volumes of one kind to be bound, and the tracing is laid away for future use. The blueprint is cut and folded over a piece of twine, as shown in Fig. 4. It is then glued to the pasteboard covers, the edges being folded in, and one of the advertising pages is glued fast to the inside of each cover as a finish. Then the book is again put in press until dry.

If the work has been carefully done, the result is a neat and substantial cloth-bound book which will present a good appearance on the shelf and will prove serviceable as well.

Melrose, Mass. ERI A. CHAMPLIN.

Drilling in Awkward Places with a Ratchet

A couple of iron-workers were fitting gratings over the windows of a bank. There were a lot of holes to drill in the window castings in very unhandy places and apparently there was no way to use a ratchet drill. However, the arrangement shown in Fig. 1 was knocked together in a few minutes from rough material at hand; it was adjustable within the limits of the job, and made possible the use of the ratchet drill.

A mechanic had the job of drilling holes for a lot of shaft hangers in some I-beams that were so covered by concrete as to prevent him from clamping on the ratchet drill in the usual way. Fig. 2 shows the telescopic extension he hatched up to do the job.

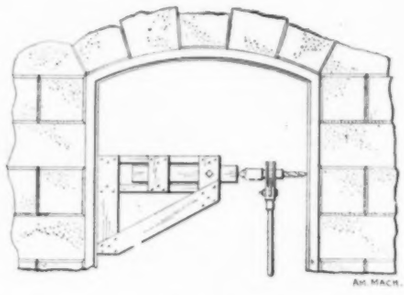


FIG. 1. DRILLING A WINDOW CASING

It consists of a piece of 1½-inch pipe telescoping into a piece of 2-inch pipe. At the upper end of the smaller pipe is welded a plug having a socket to take a flat drill with a square shank. At the lower end of the lower pipe is welded a plug having a shank to go into the ratchet drill.

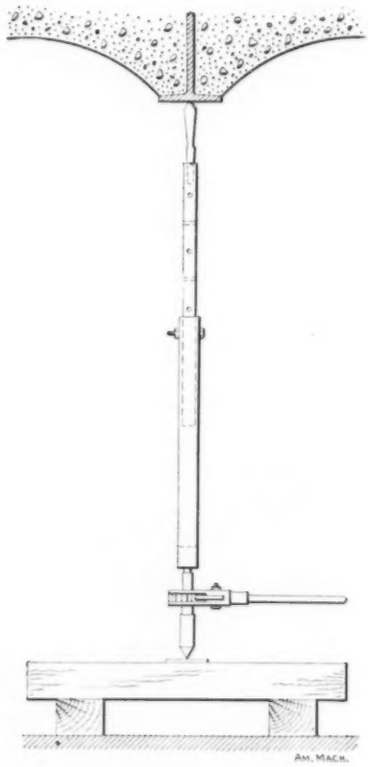


FIG. 2. DRILLING AN I-BEAM

The 1½-inch pipe had holes bored in it every 6 inches of its length to permit of a large range of adjustment. The 2-inch pipe had a hole and through-bolt to clamp the two pipes together when adjusted for length.

C. A. CROATMAN.

Woodhaven, N. Y.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Patents

I have read with considerable interest the various discussions of the patent question and more especially the letters of Mr. Kimball and Mr. Logue on pages 169 and 416, respectively. Until recently I have been identified with some of the leading patent attorneys of Boston and have had experiences with inventors of many nationalities and every description. I have personally covered the field from the making of the drawings to the actual prosecution of the applications for letters patent in the United States Patent Office.

To the average layman a patent is a sacred document which brings to its possessor the key to the treasure vaults of the world. Instead of this, however, it is usually the cause of the inventor's rude awakening to the fact that "all is not gold that glitters."

There are two great classes of inventors; on the one hand, those who invent "world-beaters" which are expected to revolutionize the universe over night, and on the other, those who devote themselves conscientiously and consistently to the attainment of certain improvements and refinements in the machinery and processes which directly and indirectly advance the standards of the arts and sciences.

When one stops to consider that over 1,000,000 have been granted in the United States alone and that hundreds of thousands of patents have issued in foreign countries, all of which must be carefully examined to guarantee absolutely that in so far as they are concerned, an alleged invention is, in fact, new and novel, he will realize what a difficult task he expects the examiner to perform. To do all this, the government receives a fee of $15, the final fee of $20 not being due until the patent is allowed. Were the government to guarantee a patent, the fees would be so great and the time required so long that the whole District of Columbia would be scarcely large enough to accommodate the army of clerks required to do this work.

A patent is, in reality, a license to fight or an introduction to the courts, and this view is accepted and shared by the inventors of the things which are really worth while.

The Patent Office does not deal in ifs and buts; it deals in facts. When a man draws his claims in such a manner as to entitle him legally to a patent, it is not the examiner's business to say that he cannot have it because John Doe has just patented a similar device. There is a book entitled "Rules of Practice in the United States Patent Office" which is free for the asking, containing the necessary information for inventors, to guide them in the preparation of their applications for letters patent.

There is, however, a science in the soliciting of patents which cannot be learned in a day. When a man is ill he sends for a physician, although he may buy a book on medicine and be his own doctor. When a man has a legal matter on his hands, he retains a lawyer, though he may study law and prosecute his own case. When a man desires to build a house he engages a builder, though he may devote a few years to the building trades and do the job himself. When a man wants a patent issued to him for the protection of his ideas he should engage a competent patent solicitor, although there is no law to prevent his prosecuting his own case. In any event, when one wants the best service he should engage somebody who has spent the time and money to qualify himself as a specialist in his particular line. There are unskilful physicians, poor lawyers, incompetent builders and unscrupulous patent solicitors but that is no reason for condemning everybody engaged in these pursuits.

One cannot buy anything unless he has the price, so I can see no good reason for excepting patents, even if they are dealt in by the Government. It has been my experience that when a person possesses genuine ability he can usually find a ready market for his inventions.

WILLIAM C. GLASS.

Dorchester, Mass.

The letter of Mr. Logue on page 416, relative to my article entitled as above, calls for additional comment.

In the first place, objection is raised because the examiners allow patent after patent on the same device. It is well known that a patent can be obtained for a process, an article of manufacture, a machine, a composition of matter, or *an improvement upon one of these four.* Would it help matters to cut out patents on improvements and only allow patents with broad claims? Well, hardly! Practically every one of the valuable machines in common use today are valuable, not because of the original conception, which was often crude and imperfect, but because of the improvements which have brought that machine to its present perfection. It is impossible for the examiners to say that this or that improvement should not be patented because it is not liable to be an advancement in the art. If it is enough different to be patentable, then it may be enough different to overcome previous objectionable features and take the market.

Now to my mind the great difficulty lies not in the system but in its abuse. The conceiving and patenting of an invention is a delicate piece of work. Like being a good toolmaker, it calls for considerable skill and experience. Yet most inventors seem to think that this difficult field is not an art to be studied and gained by experience, but a privilege open to anyone, like walking up and filling out a telegraph blank.

Suppose a man climbs into a locomotive cab and attempts to run a train to its destination. He knows nothing of the track or the signals and lands the train in the ditch. Is it the fault of the railroad? Should the road have a system so perfect that any fool could run a train?

Mr. Logue speaks of inventions on trolley wheels which had come under his attention and says: "The great majority of the patentees of these devices had probably never had a good look at a trolley car." Then what business had they taking out patents on trolley cars? It is just such cases as that which make true the statement that 99 out of 100 patents are not worth the paper they are printed upon. The Patent Office isn't a summer house full of play things.

Now I do not say that there is nothing wrong, but I am saying that but a small fraction of the complaining can be rightly charged to the patent system. The bulk of such complaints is chargeable to the inventor and to the attorney.

The average applicant for a patent thinks if he gets a patent at all that patent should be a broad one. He fails to realize that there is a legitimate use for narrow patents as well as broad patents, just as there are cider apples and eating apples.

The attorney, it is true, often pulls the wool over the eyes of the inventor. Thus if in the first letter from the Office there is information which shows the patent will be valueless, it may be that the inventor is not informed of the fact. It is easy for the attorney to cover up any-

thing of this kind if the inventor lets him, as all the correspondence is between the attorney and the Office. Of course, not all attorneys act in this way. Some are broad gaged enough to put their client's interest ahead of or at least on a par with their own. They show the inventor the references cited by the Office and go over with him the question of the amendments which will be necessary to overcome the examiner's objections.

The inventor should see that his attorney gives him a copy of the application as filed, then he should see that he gets a copy of each letter to and from the Office and should go over carefully every reference cited. This will enable him to judge of the value of his invention and his attorney is then in a position to discuss the case profitably with him.

If the inventor turns his case over to an attorney and has nothing more to do with it until he receives the patent, then he has no one to blame but himself if the patent is worthless. You cannot drop in a fee, push the button, and take out a good patent. That is, not very often. Of course, patenting inventions is a gamble under any system, and if a person cannot afford to play the game and lose, he had better keep shy. But where a person is tempted to invent outside of his line, he had better get the temptation behind him. If he thinks that all the skill and experience necessary should be furnished by the Patent Office or the attorney, he will be apt to find himself the owner of one of the 99 poor patents, and it will not be the fault of the system.

IRVING D. KIMBALL.

Lowell, Mass.

Shop and School Education

In his article on this subject, Professor Kimball, on page 607, takes me to task for exactly the thing that I expected to hear from, and that is my expressed belief that apprenticeship decayed from lack of apprentices, and that the school part is a necessary "bait" or inducement to bring in the boys. The Commission on Industrial Education of Massachusetts, which he quotes, also printed a résumé of the views of a number of manufacturers in the 20 largest cities of the State. In this résumé we find the following statements: "Many of us are not taking on apprentices and we realize that the situation is rapidly growing worse. Competition is so keen and the average boy obtainable is so untrustworthy that we cannot afford to take on apprentices, it would be a losing game financially." "Apprenticeship has failed largely because there seems to be no sense of responsibility in either the boy or his parents."

The above quotation would tend to show that a class of boys presented themselves as candidates for apprenticeship much below the grade of those necessary to recruit the trades.

Right here I wish to make a digression for the sake of saying that there are a large number of well educated and well meaning people who are doing the cause of industrial education more harm than good by their insistence that any boy who is useless at anything else, or who is too thick headed for any other form of education should be taught a trade. It is true that the average operator in a machine shop is not of a grade that would cause anyone to distrust this opinion, and it is also true that the all-around mechanic of the best grade will not average to present an appearance in society that will compare favorably with that of the professional man, but when the machinist is in his natural surroundings he is the equal in intelligence, reasoning power and foresight of lawyer or professor. I realize that this statement will be questioned, and I realize that the larger part of my acquaintances are mechanics rather than professional men, yet I firmly believe that it is correct.

WHERE SHALL WE GET PUPILS?

It does not seem to me that Professor Kimball's quotations from this same report show what he wished to prove. I happened to be well acquainted with the men behind this report and I know that the thing which chiefly troubled them was, "Where shall we get our pupils?" It is true that they found that there were 25,000 children of 14 or 15 years of age who were not in school, but there is no statement of how many of these would have learned a trade if the chance had been offered, nor is there any statement showing how many of that group would have been acceptable to manufacturers. The statement goes on to say, as quoted by Professor Kimball, "33 per cent. of the children of this state who begin work between 14 and 16 are employed in unskilled industries and 65 per cent. in low-grade industries, thus a little less than 2 per cent. are in high-grade industries." This does not mean that the 25,000 are distributed in this proportion, because not a large proportion are in the industries at all and the word industries as used does not mean trades alone. It is a lamentable fact, but a well known one that boys are very apt to wish to leave school, not to enter a trade but to get in an office, or to sell goods over a counter, or to drive a wagon, or any one of the hundreds of industries that present a more pleasant approach but a much less desirable future.

It is true as the report states that parents will almost invariably lay the blame for their children's leaving school on the child, and that the child will lay his desire to leave school to the necessity for earning money. When we get at the truth of the situation, and in this case I speak only of local conditions, we find that parents leave the boys to find their own way of earning their pocket money, and that the craze for more pocket money leads the boys to want to leave school. This same craze leads them to look for the employment that pays them best in the beginning. This in turn leads them to peddling popcorn at ball games and ushering at theaters, for they find that a few hours of this work pays them larger wages than 10 hours in a shop, as well as leaving them more liberty.

The Commission on Industrial Education found that out of some 2000 cases of boys applying for positions the younger boys almost all declared that they would not have stayed longer in school if they could have been taught a trade, but they also found that the boys of 18 years expressed a belief that they would have stayed longer. The psychology of this is that they found out by the time they were 18 that it would have been better for them to have learned a trade.

WHAT INDUSTRIAL EDUCATION CAN DO

What industrial education can do for our boys is to give them an inviting entrance into trades that it is worth their while to learn. This is not in any sense a flim-flam game; the skilled industries can deliver the goods to whoever will fit himself to enter them. It is simply raising the standard of training for the trades above the sordid surroundings in which it has found itself in so many cases.

I agree with Professor Kimball in his conclusion (*c*). The opportunities for acquiring a trade are much more plentiful for the boy who has been held in school a few years longer, especially if his training has been along industrial lines, only provided that these industrial lines are real and not imaginary. That is, I cannot see that "preparatory trade training," as one of the AMERICAN MACHINIST'S correspondents calls it, is anything so specially desirable. I believe that a trade should be taught in a shop by shop men. I also believe that this shop should properly be a part of a school, and I believe that the mathematics and science taught in the school should be entirely subservient to the shop and that the problems discussed in the school rooms should be taken from the daily practice of the students so far as possible. If this shop is a shop then a trade can be taught there provided the pupils can be gotten and held. Experience seems to show that this can be done.

Preparatory trade training sounds to me as if someone had a desire to do the right thing but that he lacked nerve to go ahead and do it. I believe all these schools really think that they can teach a trade and I believe that they hope to do it, but they prefer to do it in the dark. I doubt if anything was ever gained in this way. Come out and put the name

TRADE SCHOOL over your doors, man fashion!

Work Done While Learning Can Be Used

I do not admit, as Professor Kimball suggests, that the patterns made by boys while learning the use of wood-working tools are not likely to be of much use, though I do grant that the elements of such work can be taught much more quickly by an organized method of teaching, provided that the practice is individually supervised. I notice that if I get patterns made at the Worcester Polytechnic Institute or at the Worcester Trade School I come pretty near paying as much as at any jobbing shop, and I wait quite a bit longer for them. Neither of these concerns seems to be sufficiently anxious for work to take it on other than a business basis. I see no reason why, under competent instruction, the first pattern a boy makes should not be usable. Of course, if the instructor is competent it means that the boy will be started on something less complicated than a gasolene engine cylinder.

In conclusion, I wish to say that I feel as Professor Kimball does that he and I agree in the essentials, but differ in our way of getting through the details; at the same time nothing but good can come from a frank discussion. I hope that industrial education may enable thousands to walk where they would otherwise creep, but I hope to see it done by attracting those with the mental and physical equipment to honor the trades rather than by educating boys whom nature never intended to be skilled workers. There are no more discontented people to be found than the over-educated. By this I mean those people whose brains have been filled with a stock of knowledge and who lack the common sense to put it to practical use.

Boston, Mass. Ex Manufacturer.

Training versus Production of Apprentices

Mr. Godfrey's article at page 294 brings up a point that is worthy of considerable thought and discussion when he suggests that some of our trade schools should forget all about production and try an intensive system of teaching the operation of machines. This is being done in most technical schools today, but for another purpose. At the Massachusetts Institute of Technology, Pratt Institute, Cornell, Illinois and Purdue it is being done with some 200 to 300 hours' time and here in Worcester at the Polytechnic Institute is given in about 450 hours. They are all succeeding in doing what Mr. Godfrey suggests, but with what and for what? With a picked lot of boys whose ambitions reach far beyond the walls of a shop, and for the purpose of giving them a training that will enable them to reach the higher engineering positions.

The boys often go out into shops during vacations and only half often enough after graduation. On the average they make an excellent showing, always bearing in mind that their whole shop training might have been concentrated into 10 weeks' time at the most.

Why should not we set up a 10-weeks' course and graduate just such boys? We could with a picked lot. We have here at the Worcester Trade School 160 boys of whom 60 are learning the machinist's trade. Out of the 60 there are about 10 with whom we could do just this thing provided we did not have the other 50 around in the way. If this was a private shop and we needed only 10 boys we would, of course, immediately dispense with the other 50 and then we would hold up the results that we got with the 10 to the world as an example of what all schools ought to accomplish. If we were a private shop and needed the 60 we would keep them all and pray that the next lot of boys would be better, which prayer would, however, remain unanswered. In the mean time we would realize that it would take time and a lot of it to put these boys on the 10 weeks' level of the other ten.

How to Treat the Few

On the other hand, being a public institution, we feel that we can be slightly altruistic, therefore, we say to ourselves, here are 10 boys whom we might make into fairly effective operators on a number of machines in 10 weeks. But this very fact shows that they are capable of better things, therefore, we will try to put them in the way of doing better. We will teach them the why's and how's of the shop. We will teach them, not merely to perform certain operations, but to decide intelligently what those operations shall be and what is their best sequence. We will try to make them competent to plan work. We will give them a general education in all the things which they would get in the public schools which our experience has shown us to have a real value, not alone in the shop, but in meeting with their fellow men. We will teach them to talk and act in such a way as to give the impression that they are capable men without advertising to the world their particular trade. In short we propose to put them in the way of making every particle of success, of which they are capable.

We would send these boys along to some technical school if it were not that we knew that each has something that prevents his being able to take advantage of such training, whether it be a lack of aptitude for Dutch or Latin or whether it is some one of the hundred other foolish details that have prevented many of our best engineers from carrying off a degree.

I have gone into this detail because one of the stock criticisms of trade schools is that they prevent boys from reaching that goal of all patriotic youth, the White House, it being understood, notwithstanding certain illustrious examples, that entrance there is barred to those who have worn callouses on their hands. These people hold up their hands in holy horror at any scheme of education that does not lead to Johns Hopkins or Clark University, with a possibility of a few years in a German University.

How to Treat the Many

How about the other 50? Why these boys need whatever we can give them if it is only to do things parrot fashion, if they do that well. They need this training vastly more than the 10 because the 10 will get along in the world any way. These are the chaps that should get the long indeterminate sentences, so long in fact that they must be pardoned out before they have reached the point where we would like to carry them. These boys, without our help would be doomed to dig ditches, tend bar or drive grocery wagons. Our duty is to make this kind of material into the kind of workmen who will spend their lives in the shop and always be thankful that they advanced that far. Some of them may never do better than to become operators on a single machine, others may learn to operate practically every machine in the shop under direction, others may learn to work from blueprints without help. Even if this is all that we can do for some of these boys, is not that just what we are lacking in our shops today; men who can and expect to work under supervision? To hear some people talk, one would think that we were expected to turn out graduates of such ability, that the fortunate man who hired a few could dispense with his foremen and superintendents and spend the summer fishing without detriment to his business.

It should be borne in mind that promotion is easy and necessary in a country that is growing as fast as this is, that men who show any willingness to accept responsibility have it thrust upon them; as a consequence the very men who would make ideal workmen do not stay in the rank and file but are promoted to be leaders before they have a chance to mature at the lathe or bench. As a result we must continue to recruit our ranks from those to whom the pay that we are willing to give a journeyman machinist looks large.

As I started out to say, this is a large question, and one that is worthy of discussion by men who view it from all angles.

Worcester, Mass. Σ. H. Fish.

Producing Threads by Dies or Rolls

In his article on the above subject, J. P. Brophy, at page 19, refers to crowding action as taking place between the threaded work and the die when the cutting edge of the die is ahead of the center any considerable amount.

Now, referring to Fig. 1 herewith, which is an exaggerated reproduction of his sketch, *b* is the depth when the die is cut ahead of the center the amount *c*, while *a* is the distance on the center line. At *b* the dotted lines show *b* laid off in the new position after the work has advanced to the center line and I think shows very clearly that it does not jam, for distance *b* was measured parallel to

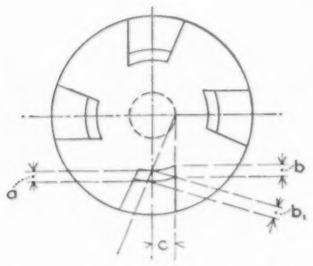


FIG. 1. DIAGRAM OF CHASER POSITION

the center line, but is at an angle to it at *b*. This can also be substantiated by analysis, for the die being produced by a hob, the circle passing through the bottom of the thread is concentric with the circle passing through the top of thread, therefore, the thread tooth is no longer at one point than at another, and as the work turns in a circle there can be no crowding.

I show in Fig. 2 a formula for grinding the thread tool, the derivation of which is simple and I think can be grasped by the average toolmaker. I have used this formula for the solution of so many problems, and it is so simple when once it is grasped, that I would like to give a rule for its use. In all problems where the triangle is "tilted" on its base as at *A*, Fig. 2, this side is common to both triangles, express both sides of the unknown triangle in terms of the *B* side of the unknown triangle. As the tangent of the unknown angle equals one side, *A* divided by the side *D*, and these are both expressed in terms of *B*, the result is simply arrived at by cancellation.

E. A. ERMOLD.

Philadelphia, Penn.

Form Letters

Oscar E. Perrigo, Volume 35, page 252, reminds me of Mark Twain at the time when he wrote that celebrated speech for any occasion. His scheme certainly looks better than the usual one in which the recipient simply notes on the letter a number which indicates to the typist that a certain form is to be used. Of course, the fact that the typist occasionally mistakes the number 3 for 8 is no worse than some of the mistakes that she normally makes unaided, but it is more likely to get by without being seen. By Mr. Perrigo's scheme we can always hope, as we do at a vaudeville show, that the next act will be good, for the law of chances would hardly allow of more than one misplaced paragraph in a letter on the part of the typist. To be sure there is no danger that the author will mix his signals and order a dun in place of a paragraph of congratulations. Then, too, I should think that the author would get in-

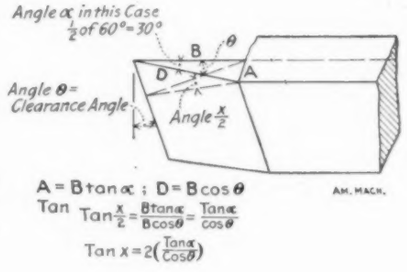


FIG. 2. TOOL GRINDING FORMULA

terested in reading the finished letter to see how near it fitted the case.

I used up the larger part of July fuming around and increasing the temperatures of the New England States trying to get an intelligent reply to some entirely pertinent questions about some machinery. Evidently the boss had gone away and left a pack of form letters on his desk with instructions to the janitor to shuffle every morning. I had samples of the whole pack and started on the second lap before I was able to impress it on the office force that I really intended to get a sane reply or there would be no business done.

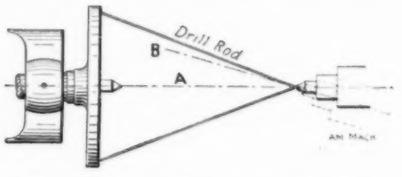
The real objection to form letters lies in their abuse. The individual who writes them realizes their inadequacy, but he feels that in order to vindicate himself he must use them on every occasion, regardless of whether they have any connection with what he wishes to write or not. On the other end of the correspondence there is usually some man who wants to get a letter that means something and which he can read in between the lines, but there is no "between the lines" to a form letter and no one realizes it better than the recipient. When I set out to get up form letters I believe that I will get my worst enemy to write them for me and then I will not feel under obligations to him to use them except as a last resort to keep away from nervous prostration.

Springfield, Mass. ENTROPY.

Testing the Parallelism of a Lathe

The piece of drill rod that John B. Uhl carries about in his kit is, no doubt, a handy thing to have, but when used to prove whether a lathe will bore parallel as he describes on page 136, it is somewhat of a failure. All that it will demonstrate is, whether or not the tail center lies on the center line of the headstock. In conjunction with the test indicator and a parallel mandrel, the method is useful, but by itself its usefulness is limited and the diagram is given to show its limitation. In this diagram, two conditions are shown, each of which would be certified by Mr. Uhl's method, as giving us a parallel bore.

Now, if the center line *A* passing through the head and tailstock is paral-



TESTING PARALLELISM OF A LATHE

lel to the lathe guides, it ought to bore parallel. On the other hand, if the center line *B* passing through the tailstock is parallel to the lathe guides, then the lathe would not be expected to bore parallel, and yet, as mentioned before, each of these cases would, by the method of trying the drill rod all round, give the same result, the probable errors of the lathe being purposely exaggerated in this case.

If, after the drill-rod test has been applied, the dial test indicator registers zero when run along a parallel mandrel placed in the centers, we might assume that the lathe would bore parallel, but years ago I reached the conclusion that the only certain way of knowing whether a lathe bored parallel, was to put in a boring tool at the proper hight and bore a hole.

WALTER G. GROOCOCK.

Woolwich, England.

Making Corrugated Cans

We make sheet-metal cans shaped as shown in Fig. 1, from 28-gage black stock, sheet steel, and having run into some difficulties would like to know how a set of corrugating rolls should be constructed to do this work? How to lay out rolls so that the can will not crimp on edge at guides or run out at open end of rolls, or jump at seam and produce an indentation further on when they come back to the can after the jump? What proportions should the diameter of the rolls be to the diameter of the can to be corrugated, or is this unimportant? What surface speed should rolls run at?

Should upper and lower rolls be the same diameter? How should wooden idler roll be set? Simply knocked into position until can runs without wabble, or is there a relative place for them in relation to the driven roll?

The corrugators used are made to corrugate one-half of two cans at the same time, a can being put on the right-hand rolls and one-half corrugated, then moved to the left-hand side and the other end corrugated, while the first end of a second can is being corrugated at the right-hand side, and so on.

Now in regard to blanking punches and dies for the same kind of metal: Originally the plant was equipped with hard

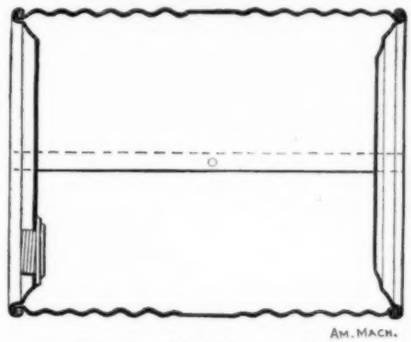


FIG. 1. CORRUGATED CAN

dies and soft punches, the latter when they became dull being upset and sheared or turned to fit the die which had been reground, but these were replaced with hardened punches and dies and from 25,000 to 30,000 blanks were cut at a setting on circular pieces 10 inches in diameter. The dies were ground with one degree of clearance and the punch made one degree larger at the back, and just allowed to enter the die. This increase at the back

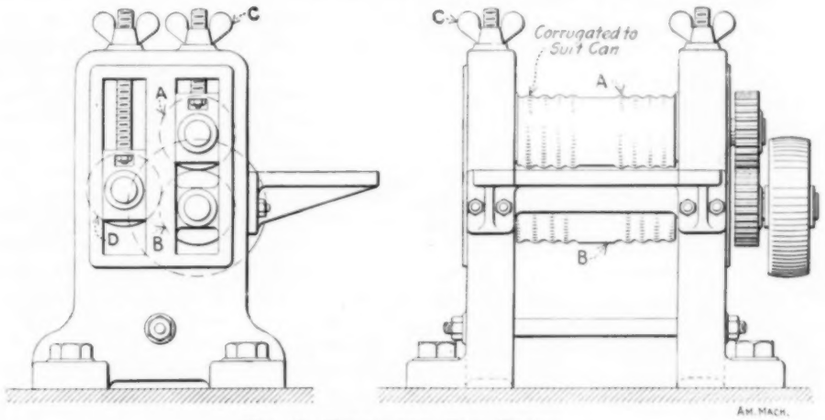


FIG. 2. ROLLS FOR CAN BODIES

was to take partial care of the clearance in the die as it was ground down.

We have always found that we had better results when the punches and dies were new and fitted perfectly, having made as high as 40,000 blanks at a setting, but have always understood that there should be a clearance of $\frac{1}{16}$ of thickness of metal between the punch and die, and in one of the late issues of the AMERICAN MACHINIST a writer states that if the punch and die fit neatly, they will wear out much faster, as the action of a hard punch past the edge of the die dulls it rapidly, but this has not been our experience.

Referring to the use of oil, it was suggested a short time ago that on this 10-inch blanking die an oiling device be used, composed of a piece of sheet metal made cup shaped and fastened by arms to the upright of the press, through which the punch worked surrounded by oily waste. This seemed at first a good idea but instead of using a pan the upper side of the stripper was cupped out and a strip of soft felt saturated with oil laid in, over which a retaining strip of sheet metal was put, then the stripper was adjusted until the felt hung just below the edge of the punch, so that with each descent of the punch the felt passed over the edge and lubricated it. Everything worked nicely in this arrangement, but it reduced the output between sharpenings from 20,000 to 30,000 to from 9000 to 14,000, the opinion being that while the punch and die were perfectly sharp, oil aided the cutting, but as soon as the keen edge was worn off the oil aided the punch to slip and drag metal into die.

[The above questions were submitted to one of our contributors, and his explanations follow.—ED.]

In making small or medium-sized sheet metal cans with the walls corrugated for increased stiffness or perhaps merely for appearance, there are several ways in which this operation may be effected. With the smaller-sized cans, I have often obtained very satisfactory results by using a corrugating die in the press, taking the rectangular body blanks and pressing in the corrugations while flat, after which the blanks may be easily rolled to proper diameter with a plain rolling machine, the principal of which is shown in Fig. 2. It will be seen that the rolls *A* and *B* are geared together and *A* is adjusted up or down over *B* by means of the wing screws *C* so as to accommodate the varying metal thickness. A third roller *D* serves as the idler or break-down roll and is also provided with vertical adjustment to enable the proper curvature of can body to be attained. Guide strips at the entering side of the rolls keep the stock square when feeding in. It is only necessary to pass the blank once through the rolls, after which it is sprung apart and removed.

I generally use power-driven rolls with a throw-out mechanism, so that they make one revolution of the can body and then stop automatically. The speed at which they should run is more or less arbitrary, but the metal should travel about 30 feet per minute. Some operators can handle a higher speed than this, however, depending upon the size and nature of the work and upon their experience.

Medium-diameter can bodies may be rolled after corrugating, even with the edges turned for seaming, without any trouble, we having rolled automobile-lamp bodies of No. 20 Brown & Sharpe gage brass with the seaming edge turned before rolling, and obtained excellent results. The other method of corrugating is done with a pair of "horn rolls" by slipping the can body over and between them, but with this method it is difficult to guide the work accurately, owing to its constantly drawing in while corrugating.

THE DIAMETER OF THE ROLLS

It should be mentioned that with a three-roller machine the roll diameter does not bear any relation to the can diameter, merely being small enough to get inside the can and large enough for proper strength.

Regarding punches and dies for sheet-steel can work, the dies should, of course, be hard and the holes relieved with a one- or two-degree back angle for punch clearance and to let the chips through. The punches should be hardened and have parallel sides instead of being tapered, as sometimes made to compensate for die grinding. There is no difficulty in drawing the punch temper and upsetting the lower ends when the die opening gets too large for clean shearing of metal, and then rehardening and grinding the punches. The upper part of the punches should be drawn to a deep straw, while the cutting edge may be left a trifle harder.

OUTPUT OF DIES AT ONE SETTING

The output per setting of dies will depend on the character of the metal, the fit of the punches in the dies, the steel and temper of the dies, the accuracy of alinement of the upper and lower members of the die and the amount of lubrication of the stock. The punches should not enter the die more than 1/32 or 1/16 inch, for if they enter deeper there is useless chafing and wear of the punch and die surfaces. It is very important to

have the presses in good condition, so that the ram has no lost motion in its guides, otherwise the punches will not register truly with the dies and will shear their cutting edges.

For lubricating stock, the simplest method is to swab the surfaces of the stock with an oily rag, using lard oil as a lubricant, but where the work permits of their use, felt oiling rollers may be used, through which the stock is drawn, thus evenly oiling it on both sides at once before entering the press.

Attention to the above point will undoubtedly improve the character of the output for those who produce this class of goods.

Detroit, Mich. ARON LAWRENCE.

Centrifugal Tension in Rope Drive

The article on page 484 under the above caption cites some instances of high-velocity rope drives that would tend to explode the old established idea of "centrifugal tension," and remove entirely all limits as far as speed is concerned.

In spite of the examples given, however, I doubt very much that engineers as a whole would accept the statements made as sufficiently reliable and accurate to be guided by them in making a large or important installation. A maximum velocity of about 5000 ft. per minute will probably not be exceeded until at least some further demonstrations have proved conclusively that higher speed can be maintained satisfactorily. This might be attributed, perhaps, to the ultra conservatism of the engineering profession, which is, no doubt, a very laudable position for it to take, for all engineering work involves more or less large sums of money and no chances can afford to be taken.

However, I cannot see how a rope running at an extremely high rate of speed can last as long as one running at a lower rate. There are, as everyone knows, two kinds of wear on a rope; namely, external and internal, both of which are due to friction. Now it would seem reasonable to suppose that the oftener the rope runs over the pulleys the more wear there will be externally, due to the friction between the rope and the pulley, and internally, due to the fibers rubbing against each other. It would follow, therefore, that the higher the velocity the greater the wear, and consequently a shorter life.

This would mean that, from a viewpoint of economy, there is a limit to the speed of the rope, for it would no doubt be cheaper to have more ropes at a slower speed than a few ropes running at such a high speed as would necessitate renewals frequently.

As for the question of "centrifugal tension," the main point discussed in the above mentioned article, I should think it would be rather difficult to successfully refute the old theory that greater speed diminishes the pressure exerted between the rope and circumference of the wheel, thus reducing the friction between the rope and the pulley.

Pittsburg, Penn. EVERARD BROWN.

Twisting Lathe Beds into Shape

It is the practice, I am told, with certain instructors, in order to test the power of observation of their students, to request them to walk slowly past a store display window, observing carefully its contents, and later name as many of the articles as they can from memory.

The remarks of John R. Godfrey, page 459, on some interesting photographs he saw of how some trade-school boys built a speed lathe, would indicate that he employed this method for he says, in lining up the lathe bed they had a test bar and were sliding the indicator along the bed while an assistant was driving shims under the legs. I, too, not only saw these photographs, but know the conditions under which the lathe was built. As a matter of fact, there was no photograph showing the boys lining up the bed. There was, however, a photograph of two boys leveling the bed, one noting the level while the other was driving shims under the legs, but the process leading up to the use of the indicator on the test bar was as follows: Not having an iron floor or a surface plate large enough on which to assemble the lathe, the boys were compelled to use a wood floor, thus making it necessary to have the bed absolutely true before assembling. The straps were removed after the bed had been finished planed, and while at rest on the planer table it was tested for torsion or twist, which was found to be 0.002 inch. A few strokes of the scraper eliminated this error, after which the boys strapped the bed on the planer table, and scraped the V's to a test slide that was a duplicate of the headstock and footstock. The truth of the parallelism of the V's, both vertically and horizontally, was determined by clamping the indicator to the planer crosshead with the indicator point resting on the V's and running the table back and forth. The straps were then removed, and a ¼-inch plug gage placed under two opposite corners of the bed to determine by indicator if it would twist while resting on two points. No twist whatever could be discovered. It was evident then that after bolting the legs in position, the bed could be leveled as mentioned above, securely lagged to the floor without twist, the boys could proceed with scraping the headstock and footstock, line the spindles to the bed by test bar and indicator, and the lathe would stand true on any level floor.

If the four boys who built this lathe were asked they would tell you they know that lathes manufactured in strictly uptodate shops are assembled on true iron floors, that they do not know of an industrial school in this country with iron floors for assembling machinery, that they are willing to demonstrate their ability along this line to anyone who will give them the opportunity, and they consider they did a good job, although they had to work in the old way.

I always read Mr. Godfrey's articles in the AMERICAN MACHINIST with interest, as they often contain many excellent ideas, but in this instance I think he failed to exercise his power of observation and neglected to learn the facts.

New Bedford, Mass. L. H. HAIGHT.

Floating Reamers

The troubles and trials of the floating-reamer proposition are constantly returning, so the following experience may be of interest. The reamer holder we use is of the sliding-surface type, made by one of the leading English toolmakers, and is used for reaming the bore of gasolene-motor cylinders 4½ inches in diameter. The trouble was that the floating holder stuck after very little use and consequently cut big. The machinist in charge had been in the habit of using "just a little" oil to make the faces slide freely, as without any lubricant at all the movement was somewhat stiff; this, however, had the objection that it gathered the cast-iron dust and soon rendered conditions as bad as without. We eventually brought the thing to its maximum efficiency by lubricating with graphite, and now every two or three days the holder is taken apart, cleaned and reassembled with fresh graphite, and the results are in every way satisfactory.

I have used many reamers of the type described by L. E. Middleton, Volume 34, page 309, and find that if the reamer happens to be in a slightly angular position when it first picks up the cut, it seems to lock itself at that angle. These reamers must be also tapered at the front when used in a horizontal machine, as the reamer drops below the center line, owing to its free movement, and must be tapered to enable it to pick up the hole, and this condition precludes it from being employed on jobs where the reamer cannot pass out at the end of the piece.

Detroit, Mich. R. BISHOP.

Cast iron has a much higher percentage of carbon than wrought iron; hence any method of setting the surplus carbon free will serve to distinguish the cast iron. To do this, dilute a little nitric acid with three times as much water; apply a drop of the diluted acid to the iron and wash it off after a few minutes. If the spot is white, the piece was wrought iron; if black from the liberated carbon, it was cast iron.

Meeting of Mechanical Engineers

The regular New York monthly meeting of the American Society of Mechanical Engineers, held on October 10, was devoted to the reading and discussion of a paper, "Factory Construction and Arrangement," by L. P. Alford, editor of the AMERICAN MACHINIST, and H. C. Farrell, mechanical engineer of the United Shoe Machinery Company.

The discussion was grouped about the following topics: (*a*) "Machine Tool Arrangement," Alex. Taylor, Westinghouse Electric and Manufacturing Company; L. D. Burlingame, Brown & Sharpe Manufacturing Company. (*b*) "Artificial Shop Lighting," C. E. Clewell, Westinghouse Electric and Manufacturing Company; G. H. Stickney, General Electric Company. (*c*) "Shop Floors," L. C. Wason, Aberthaw Construction Company; Henry Hess, Hess-Bright Manufacturing Company; Gilbert Arnold; H. J. Lambourn, Yale & Towne Manufacturing Company.

FACTORY CONSTRUCTION AND ARRANGEMENT

The paper of the evening dealt with the arrangement and construction of the reinforced-concrete factory buildings of the United Shoe Machinery Company, at Beverly, Mass., with reference to their adaptability to the manufacture of light machinery. The advantages and disadvantages of concrete floors were discussed, and the experience of this plant was given to show that such floors are satisfactory in the machine shop. The original manufacturing scheme, the one-shop plan, was described, together with the modifications that it has undergone since its inception. The original artificial lighting installation was shown with changes now being made to use the more recently developed higher efficiency lighting units. As the plant has had rapid growth, modifications based on experience have been made as new construction was undertaken, and these changes were traced in detail. Finally, the plant contains one of the first extensive developments in the use of steel storage racks. The design of these was given, together with an account of the conditions under which they were developed and the uniformly successful results in their use were shown.

MACHINE TOOL ARRANGEMENT

Alexander Taylor's discussion was read by C. B. Auel, Westinghouse Electric and Manufacturing Company. Mr. Auel described the system in use by this company and traced the development of its present arrangement, which is the output-department plan, from the original or one-shop plan.

Mr. Burlingame discussed the group-department plan by which parts of a machine are manufactured as separate units, complete in themselves, the department where such units are built being equipped at least to a large extent with the different kinds of machines needed to perform the various operations required in their manufacture.

ARTIFICIAL SHOP LIGHTING

Mr. Stickney pointed out that localized and general illumination mark two extremes of lighting practice. A few years ago when practically all electrical illumination employed either the arc lamp or the carbon-filament incandescent lamp, the line of demarcation was more distinct and practically all industrial lighting was accomplished with the incandescent lamps as localized illumination or with the arc lamp as general illumination. However, the tungsten-filament incandescent lamp now provides a range of efficient units throughout the gap in capacities between arc and incandescent lamps; hence this lamp can be well applied to installations having the features of both localized and general illumination.

Practice in shop lighting can be classified in four divisions, as follows:

1. Localized illumination with small lighting units.
2. General illumination with large lighting units.
3. Combined localized and general illumination with both large and small units.
4. Localized-general illumination with units of intermedite capacity.

The development of new efficient units has in many cases made a readjustment desirable so that a large number of shops are changing from one practice to another. Nevertheless there are conditions which, at least for the present, will make it desirable to continue with each of the four classes.

Mr. Clewell, who has written a great deal on shop lighting for the AMERICAN MACHINIST, presented an excellent paper covering many of the same points that have appeared in his articles.

SHOP FLOORS

Mr. Hess talked interestingly of torgament or stone-wood floors and special motor drives. His remarks on floors were illustrated by means of color photographs, which were rather remarkable in that a special process had to be developed for the reproduction of the rather dull colors appearing in the floors.

Mr. Wason's paper was read by Professor Rautenstrauch and as it contains some new features it will be presented in detail later.

Mr. Lambourn completed the discussion with his paper on shop floors, which also will be printed later, in detail.

Machine Tool Builders' Convention

The tenth annual convention of the National Machine Tool Builders' Association was held at the Hotel Astor, New York, October 10 and 11, and at the same time and place that of the National Supply and Machinery Dealers' Association. The session of Tuesday morning was opened with the usual formal proceedings: Roll call, reading of minutes, appointment of convention committees, report of officers, etc.

TASK WORK AS A BASIS OF PROPER MANAGEMENT

Following this, a paper on "Task Work as a Basis of Proper Management" was read by Henry L. Gantt, consulting engineer. Excerpts from this paper and the discussion will appear in a later issue. In discussion the hypothetical question was put to Mr. Gantt: "What would you do in case a man earned more than his foreman and the foreman was dissatisfied?" This question was replied to by several members, two of whom had encountered just such conditions and solved them differently but satisfactorily for all concerned.

SHOP HYGIENE AS A FACTOR IN EFFICIENCY

The second session was opened with an address by Winthrop Talbot, M.D., editor of *Human Engineering*, Cleveland, Ohio, on shop hygiene.

During the address numerous lantern slides were used, illustrating ventilation, sanitation and lighting of shops.

Doctor Talbot was followed by Doctor Clark, of the Norton Company, Worcester, Mass., who told what had been done by the concern with which he is connected to improve the physical condition and efficiency of the help. The employees of this company undergo a thorough physical examination on entering. During these examinations many minor defects, not suspected by the man himself, are noted, and corrective measures are suggested. Of the 500 men examined but two were found to be unfit to work. One on examination was found to be suffering from pulmonary consumption and was consequently turned away, the other later developed the same disease.

Doctor Clark's address will be given in full in a later issue.

STANDARDIZATION OF MACHINE TOOLS FOR THE BENEFIT OF THE USER

The next address, on the above subject, was delivered by L. P. Alford, editor of AMERICAN MACHINIST. This address is printed in full in this issue, beginning on page 725. A later issue will have a valuable discussion by Carl G. Barth on feeds and speeds.

There was but little other discussion of Mr. Alford's paper. However, there was

favorable comment in which individual members stated their approval of the principle of standardization as applied to machine tools; although some pointed out the great expense that would be necessary in order to change existing designs to meet any standard that might be set up. It was emphasized, however, that standards might be put into effect by embodying the uniform details in new designs and thus, through a gradual process of evolution, ultimately reach the desired uniformity.

President Geier advised that individual committees investigate the features that might be standardized in regard to the various machines and determine what action can be taken in this matter; emphasizing that the individual size and class standardization must precede intersize and interclass standardization.

The social feature of Tuesday evening was an "Inning" given by *Machinery* in the ballroom of the Hotel Astor. Some 800 members and their friends were guests of Mr. Luchars, at a most enjoyable entertainment, the program of which was happily styled "The Operation Sheet." In keeping with this title, the various numbers were captioned from machine-shop operations, such as "Turning and Tumbling," introducing a troupe of acrobats, and "Inspecting the Hoppers," referring to the Royal Moskovitzskis Russian dancers, are typical.

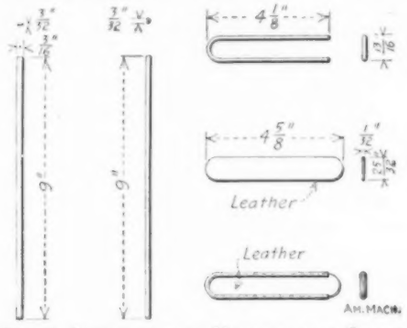


FIG. 1. STEPS IN THE MAKING OF A SCALE CASE

Two other numbers that were enjoyed by all were referred to as "Oiling Up and Lubricating" and "Feeding New Stock Into the Mechanism."

Mr. Luchars offered a handsome loving cup to the most popular builder and invited everyone present to vote. It was won by Amos Whitney.

On Wednesday evening the members, as guests of the AMERICAN MACHINIST at the Hippodrome, went for a trip "Around the World."

At the last business session E. P. Bullard was elected president, A. E. Newton, treasurer, and C. E. Hildreth, secretary, for the ensuing year. New members were elected as follows: Watson-Stillman Company, New York City; Beaudry & Co., Inc., Boston, Mass.; Lennox Machine Company, Chicago, Ill.; Ferracute Machine Company, Bridgeton, N. J.; Standard Machinery Company, Providence, R. I.; National Machinery Company, Tiffin, Ohio; Smith & Mills Company, Cincinnati, Ohio; New Britain Machine Company, New Britain, Conn.; J. N. Lapointe Company, Marlboro, Mass.

Tools for Making Pocket Scale Cases

BY JAMES STONE

The accompanying cuts show the method of making small pocket cases for 4-inch steel scales or rules, which consist of two pieces of thin leather, rounded at the ends and bound together by a metal edge leaving one end open, the various steps being shown in Fig. 1.

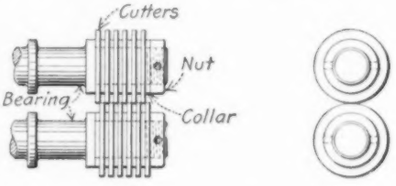


FIG. 2. SLITTING ROLLS

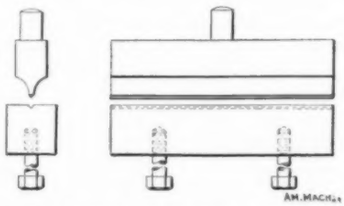


FIG. 3. CHANNELING PUNCH AND DIE

The material from which the steel edges are made comes in pieces 9 inches wide, 2 feet long and 0.007 inch thick, and this is cut up into strips 3/16 inch wide and 9 inches long in the gang of slitting rolls shown in Fig. 2, which make 12 strips at each pass.

The next operation is to channel these strips with the punch and die shown in Fig. 3, after which they are bent into V-shape in the device shown in Fig. 4. In bending these pieces one is placed as shown by dotted lines at *G*, pushed up close against the guide and held there lightly with one hand while the slide is moved along by pulling on the handle; the punch forcing the channeled strip through the die, making them nicely rounded and free from buckles. These pieces automatically strip, as the ends spring enough to catch on the die as the punch is withdrawn.

The leather sides of the case are cut out with the tool shown in Fig. 5, a wooden board being used for the bottom. In this cut *A* is a stripper for pushing out the cut leather and is operated by the spring above it; while *B* is the cutting edge of the tool.

Assembling is done in the die shown in Fig. 6, the parts of the case being put together by hand and then placed in the die and clinched by the descent of the punch.

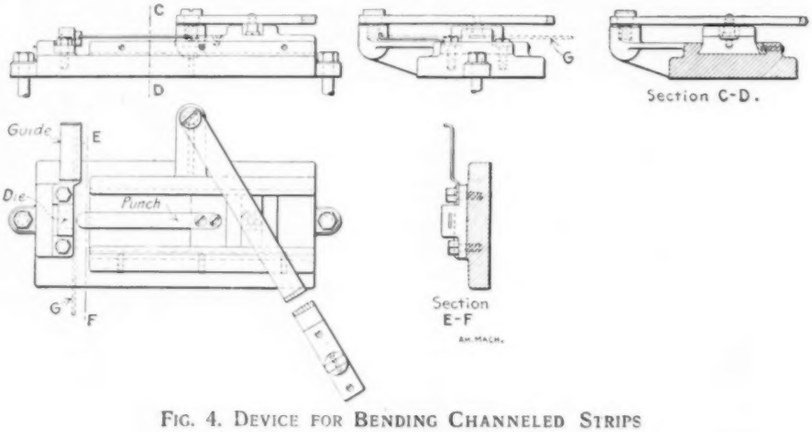


FIG. 4. DEVICE FOR BENDING CHANNELED STRIPS

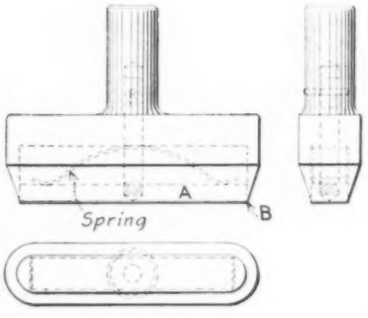


FIG. 5. LEATHER-CUTTING DIE

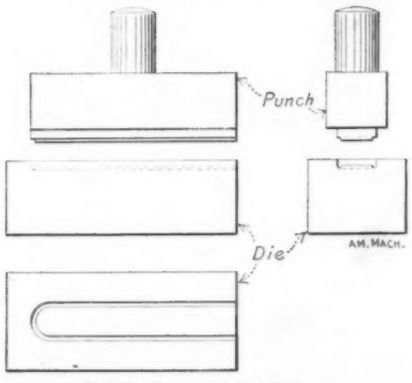


FIG. 6. ASSEMBLING DIE

Issued Weekly by the

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Of this issue 22,000.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 153

American Machinist

Standardization of Machine Tools

On page 725 we print an address given before the convention of the National Machine Tool Builders' Association, on the subject of "Standardization of Machine Tools for the Benefit of the User." It is needless to emphasize the importance of this subject except to quote the last sentence of the paper, "Standardization of machine tools . . . . . is the greatest constructive step in machine-tool design that I can imagine."

To present the user's interests fully and completely, we invite an extended discussion of this subject in our columns.

High Speed Steel Again

When high-speed steel first appeared it was confidently predicted by all but a few pessimists that it would revolutionize the machine industry. Years enough have passed to justify a review of the revolution.

The difficulty which the reviewer at once encounters is the elusiveness of the revolution. When he is just ready to drop a pinch of salt on its tail it fades away into nothingness. When he meets it head on he walks through it as easily as through a ghost. When he investigates a particular shop he finds, instead of an output three times as large per man as it was in the days of carbon steel, that the increase is only 50 per cent. and that there is a production specialist at each corner claiming credit for it all. When he hunts up the manufacturers of machine tools and investigates the new designs made to get the whole worth of the new steel, he may find them plodding along with the new designs in their agents' stores and the old patterns in the shop being manufactured. Then he wonders, "Why?"

He finds that only a small part of the work in most shops is in the production of chips, the rest is getting ready and finishing parts already roughed out and beyond the help of high-speed steel. He finds that the new steel helps but little in the work of erection and that little is mainly as a convenience, owing to its greater staying powers. He finds that large numbers of jobs are of such a nature that rapid work cannot be done because of the lack of strength of the work itself. A shaft 18 inches long and ¾ inch diameter cannot be turned in any better time with the new steel than the old, unless a center or follow rest is used. The time saved by that means is lost in its adjustment. With all these years no one is ready to tell the workman the limits of slimness of work where it pays to use a rest, or where it pays to use high-speed steel.

Then again he finds that a drilling feed of 10 or 15 inches a minute can be maintained, but he likewise finds that when he has a casting in which the blowholes are not exactly in line with the drill he has to ask for high-speed drills with startling frequency. In all these cases there is absolutely nothing to go by but judgment, and judgment is conservative where production is concerned.

Next the reviewer finds that the reason why manufacturers do not unquestioningly buy the modern high-speed machine tools for general use is that the combination of all these experiences shows them that the added expense is not unfailingly justified. It is better in the few cases where forgings or castings cannot be kept close to size to take two cuts with the lighter and more easily operated machines, than to take all the stock at one cut with a machine that is operated below its best efficiency the rest of the time.

A Creditable Action

A most creditable act of voluntary compensation for a fatal foundry accident was recently performed by the Otis Elevator Company in distributing the sum of $30,000 among the widows and orphans of the killed and injured men of the Yonkers, N. Y., plant. The coroner held the corporation blameless and the accident unavoidable. In spite of this the company compensated the families of the workmen, doubtless holding that the workmen and their wives were likewise blameless.

It is especially gratifying to note this incident because of its bearing on the broad question of accident compensation. We are looking for better laws dealing with this matter and believe that the majority of manufacturers would welcome adequate legislation prescribing compensation for industrial accidents. After an accident has occurred no good comes to the victim or his family from an investigation of the hows and whys of its occurrence. In the face of calamity the injured and his dependents need help. After an industrial accident the patient needs compensation.

Our belief that many manufacturers hold this broad view is strengthened by this action of the Otis Elevator Company, in which of its own initiative it has followed a just, humane and generous course.

Importance of Associating Name and Location

In that asset "good will" two important factors are the firm name and location. The So-and-So company, if possessed of a reputation, is associated with a particular city or town. Firms that have changed the location of their shops have had letters sent to the old address 10, 15 and 20 years later; their early reputation was made from a certain place and in the minds of some purchasers the firm and that place were always associated.

In deciding how a product is to be marketed, this important principle should not be overlooked; the name and location of the manufacturing firm must be persistently, directly identified with the product. If this is followed the reputation of the company and its goods will be so connected as to add a maximum amount to the value of the firm's good will.

Cases are not unknown where unfortunate selling arrangements, that is, unfortunate for the manufacturer, have been suddenly terminated with the result of practically wiping out the market for a given product and necessitating the carrying-on of a long, arduous campaign to recover the lost ground.

The danger here pointed out is not so great with a patented and fully protected product, but does apply with full force to competing goods.

A. S. M. E. Machine Shop Practice Committee

The recently appointed committee of the American Society of Mechanical Engineers on machine-shop practice, constituted to arouse more interest in the society in machine-shop work, consists of the following members: F. E. Rogers, chairman; L. D. Burlingame, W. L. Clark, W. A. Diefendorf, A. L. De Leeuw, F. L. Eberhardt, F. A. Errington, A. A. Fuller, H. D. Gordon, H. K. Hathaway, E. J. Kearney, William Lodge.

New Publications

MISCHEN, RUEHREN, KNETEN UND DIE DAZU VERWENDETEN MASCHINEN (Mixing, Stirring, Kneading and the Machinery Employed for Those Purposes). By Dr.-Ing. Hermann Fischer, Geh. Regierungsrat und Professor. Ninety pages, 7x9½ inches, with 122 illustrations. Press of Otto Spamer, Leipsic, Germany. Price, unbound, 5.75 marks; bound, 7 marks.

This volume is one of a series of monographs on chemical technology, published under the editorship of Prof. Dr. Ferd. Fischer, of Göttingen. It discusses the theory of mixing different kinds of materials in various ways and the mechanical elements and types of machinery adapted to those purposes. The materials may be either fluid or dry, or, between those extremes, may have slight or a great viscosity. They may be applied by weighing out and putting together definite quantities or by a continuous feed. These considerations help to form a framework for the subject. The occasion for mixing in metallurgy, masonry and other trades brings this topic within the scope of the general engineer, and it will, no doubt, particularly interest those machinists who sometimes design and build apparatus of this class. The author's purpose has evidently been to conduct a fundamental investigation of his subject, and without attempting a critical judgment in detail, he may be accorded credit for a worthy little book.

ENGINEERING DRAWING. By Thomas E. French. Two hundred and seventy-three 6x9-inch pages; 452 illustrations in the text; indexed. McGraw-Hill Book Company, New York City. Price, $2.

The author of a new work on drawing should give an acceptable reason for having written another book in an overpopulated field. This Professor French can easily do, for he treats of engineering drawing as a complete graphical language. We quote from the preface: "This new language is entirely a graphical one. It cannot be read aloud, but is interpreted by forming a mental picture of the subject represented; and the student's success in it will be indicated not alone by his skill in execution, but by his ability to interpret his impressions."

There are 15 chapters, including a bibliography of allied subjects. The first is introductory; the second and third treat of the selection and use of instruments. These occupy 46 pages, and it might be urged that they are somewhat too complete, on the ground that technique should come from instruction and practice. But from the viewpoint of recording accepted practice in manipulating draftsmen's tools they are amply justified. Chapter 4 treats of the laying out of the curves of conic sections and other curves frequently met with in the drawing room, as the cycloid, involute and spiral of Archimedes. Chapter 5 is very well written; it deals with the important subject of lettering and presents the Reinhardt system, developed by Charles W. Reinhardt, chief of the drafting department of the *Engineering News*.

Chapter 6 deserves to be singled out for especial commendation. It begins the real subject of engineering drawing as a language, to which the previous chapters are preparatory. Here orthographic projection is developed from perspective projection in a manner which is entirely new to the reviewer. This subject of projection is usually one of the worst stumbling blocks in teaching or learning drawing; but with Professor French's method, whereby the various orthographic views are first seen in a perspective relation to each other and to the object, the student cannot fail to grasp the underlying principles readily. This chapter covers 35 pages and includes 50 problems to be worked out by the student.

Chapter 7 is devoted to developed surfaces and intersections. The illustrations and problems are well chosen. In fact, the problems should be mentioned as one of the admirable features of the book. They are chosen with a discrimination for their shop and drawing-room application, and in many cases lead the student along by giving him a partially finished drawing which he is to complete. Chapter 8 deals with pictorial representation and is very clearly written. Chapter 9 occupies 56 pages and deals with the subject of working drawings. Here the common drawing-room conventions are given; bolt, cap screw, pipe and fitting dimensions are tabulated, and numerous specimen drawings and problems presented. A slight error in shading is noted in the screw threads on page 167, in that the line connecting the roots of the threads is made heavier than the line connecting the points of these threads. The first arrangement is incorrect, as a little consideration will show. The illustrations on pages 182 and 183 are hardly in keeping with the rest of the book. They show, respectively, a working drawing of a plate girder and a roof truss. In the process of bookmaking they have been reduced so much from the original size as to be of very little value. However, these two minor points of criticism merely emphasize the general excellence of the book, both from the standpoint of authorship and as a product of the bookmaker's art.

Chapter 10 is devoted to a feature of drafting in which the average draftsman is relatively weak—technical sketching. It can be especially recommended to many men who are now earning their living over the drawing board. To complete the presentation of engineering drawing as a graphical language, Chapter 11 deals with the Elements of Architectural Drawing, Chapter 12 with Maps and Topographical Drawing, Chapter 13 with Duplication and Drawing for Reproduction and Chapter 14 with Notes on Commercial Practice. The chapter on reproduction gives the Reinhardt system, the one now used for line illustrations in the AMERICAN MACHINIST.

Although the work is written primarily as a text book, it will be of service in the library of the working draftsmen, as well as in the hands of the students.

Personals

W. A. Sibley, of the Sibley Machine Tool Company, sailed for Europe, October 14, for a five months' business trip.

C. E. Bilton has taken F. E. Seeley into partnership with him in the Standard Manufacturing Company, Bridgeport, Conn.

James T. Lee, formerly of the Hanna Engineering Works, has been appointed Chicago representative of the Mumford Molding Machine Company, with headquarters at 2059 Elston avenue.

J. W. Carrel, general sales manager of the Lodge & Shipley Machine Tool Company, Cincinnati, O., sailed, October 14, for an extended European trip in the interest of the company. He will be accompanied by Mrs. Carrel.

H. T. Stokes, for several years general foreman and master mechanic for the Imperial Stopper Company, Newark, N. J., has resigned, and is now associated with Lewis R. Compton & Co. and the Efficiency Engineering Association that is now being organized, 50 Church street, New York City.

Obituary

Hugh Elmer Clark, senior member of the firm of Hugh Elmer Clark & Brothers, Rochester, N. Y., died on September 14. Mr. Clark's most widely known invention was that of an emergency exit door lock and his designing abilities became known in connection with the ring-turret lathe, cigarette machinery, multicolor printing press and machine tools.

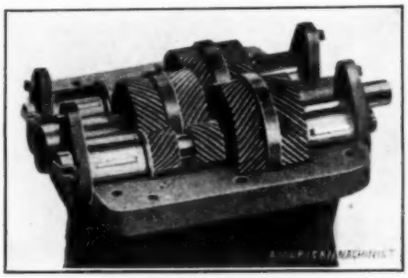
Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Transmission Gear

The transmission gear shown herewith has been designed to decrease or increase the speed on turbines, motors, propellers on ships and various classes of machinery where a decrease or increase of speed is required.

It comprises a high-speed shaft, one or two countershafts and a low-speed shaft, the high- and low-speed shafts being in one straight line, but disconnected.



TRANSMISSION GEAR

The two countershafts with eccentric bearings are so arranged that when one pair of eccentric bearings is above center, the other is below center, and the gears can be thrown in and out by a single movement of the lever while running.

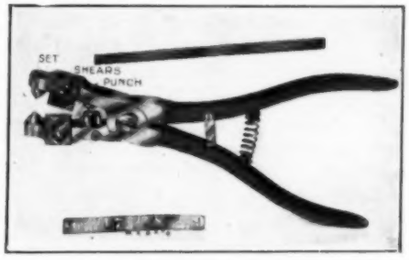
The tungs in the center of the larger gears are designed to act as a guide for side motion, help to keep the gears meshed, and reduce friction. The direct shafts have stuffing boxes and the side shafts caps, to prevent oil leakage.

The circulating-oil system consists of a tank from which the oil runs to the lower part of the gear case; the gear acts as a pump forcing the oil through suitable pipes, controlled by valves to the different bearings. From thence the oil goes to a separator and then to the tank again.

The gear is a recent development of the Sauer Power Generating Company, Pittsburg, Penn.

Steel Tape Repair Outfit

The tool shown in the accompanying halftone requires but little explanation. It combines a steel tape punch, shears and riveter made in handy form. The tool is a recent product of the Pittsburg Instrument and Machine Company, Pittsburg, Penn.

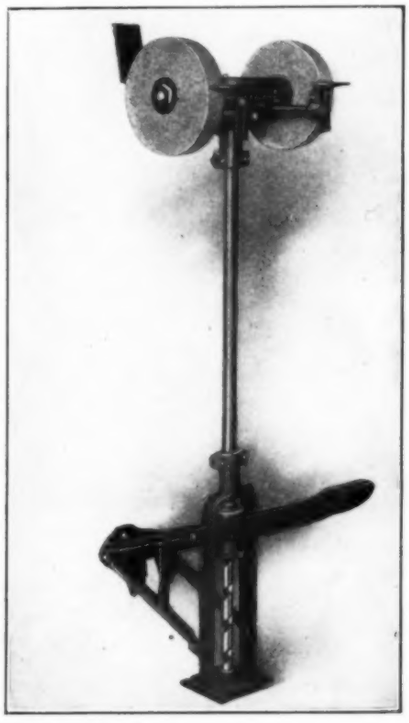


STEEL TAPE REPAIR OUTFIT

Foot Power Grinder

The accompanying halftone shows a foot-power grinder developed by the Carborundum Company, Niagara Falls, N. Y.

As will be noted it is operated by a one-foot treadle and spiral-gear shaft. Malleable iron is used in construction of parts taking the heaviest strain. The grinder is ball bearing and equipped with two 7-inch carborundum wheels, one coarse and the other fine grit. The machine is 40 inches high and weighs 68 pounds.

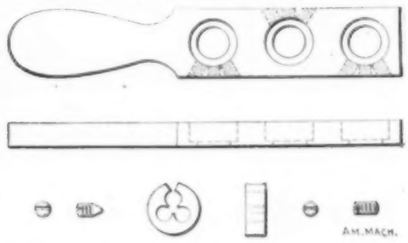


FOOT-POWER GRINDER

Die Holder and Dies

BY F. CHAS. SCRIBNER

In no field of mechanical endeavor is the need of accuracy more imperative than in the production of high-grade firearms, and the making of taps and dies for this class of work is something which no regular tap and die maker has been able to accomplish to the satisfaction of the consumer, which can be accounted for by several reasons, for the tap and die standards for gun screws used by the various makers, have been in use for many years and may not have been made to any recognized standard from the first, and the requirement of a fit between the screw and the tapped hole that will not permit the screw to loosen by the shock and vibration caused by the use of the arm, demands high workmanship and special care, which the tap and die maker manufacturing in quantities does not give nor does he hold the work to exact dimensions, but permits a plus or minus tolerance in his product.



DIE HOLDER AND DIES FOR MAKING TAPS

In the accompanying cut is shown a master die holder and die which has given excellent results in the making of working taps for gun screws. The holder is a flat piece of cold-rolled stock, bored out to hold the dies of a proper variation in pitch diameter, and is provided with screws for adjustment. The dies are of the well known round or button type, left with some thickness of metal in the slot before hardening, and after being hardened and tempered are split by grinding with an elastic wheel.

In use, the dies are run over the taps in succession, No. 1 die removing a certain percentage of material, followed by No. 2 and ending with No. 3, which sizes and finishes the taps, making them accurate and uniform in size.

Locomotive Building in Canada

Editorial Correspondence

A few of the shop kinks for drilling, planing and bending found in the Montreal plant of the American Locomotive Works.

The Montreal works of the American Locomotive Company have a number of interesting methods of manufacture but, for one reason or another, it was impossible to secure illustrations of more than those shown.

This plant is now under the general managership of Percy Webb, whose work on both sides of the water has given him a broad experience in locomotive work. This was also the scene of the most strenuous efforts to introduce the so called "standard time" system, which resulted so disastrously to the organization. This, however, is now making a good recovery from the attack and these works will be heard from much more favorably. At the present time they are working to their full capacity.

Valve Motion Work

Fig. 1 shows the drilling jigs for the sword arm of the Walschaert valve gear which they were building for some engines for the Grand Trunk Railway. This is easily and substantially made up from two pieces of boiler plates supplied with the necessary bushings for locating the different holes. This drills all the necessary holes at one setting and makes a very economical method of handling this piece.

In the same department is the first of the radius fixtures designed by Mr. Boswell, who was formerly at these works. These were illustrated a short time ago and are now being made by the H. B. Underwood Company. As can readily be seen, Fig. 3, this swings the link being planed as it passes under the planer tool and is adjustable for links of various radii.

Large Bending Fixture

Tire-retaining rings are made on the bending fixture shown in Fig. 2, which consists simply of a large round block having a raised ring in the center of the correct inside diameter, a central pin on which is pivoted, the bending arm carrying the roller and the curved rail for supporting the outer end of the heated piece before it is bent. While there is nothing unusual in such a device, they are not often found of this size, which can be seen from one of the completed rings resting against the bending lever. I am indebted to both General Manager Webb and Superintendent Fraser for assistance in securing these illustrations.

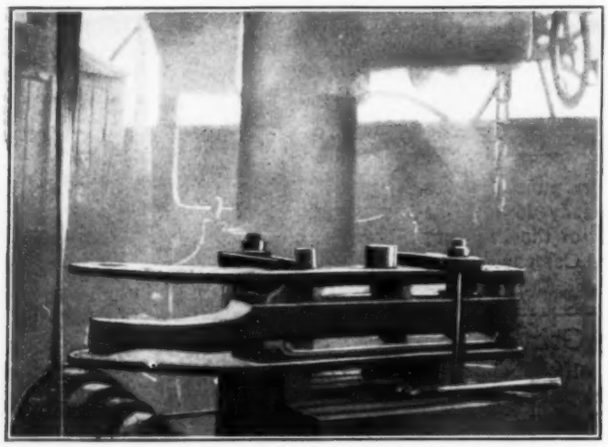


Fig. 1. Drilling the Sword Arms for Walschaert Valve Gear

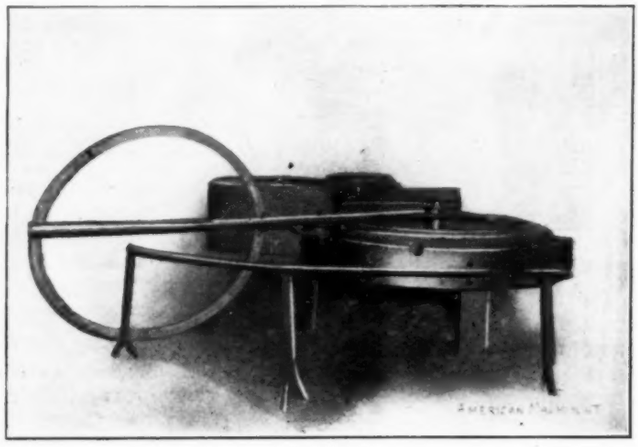


Fig. 2. Bending Driver Retaining Rings

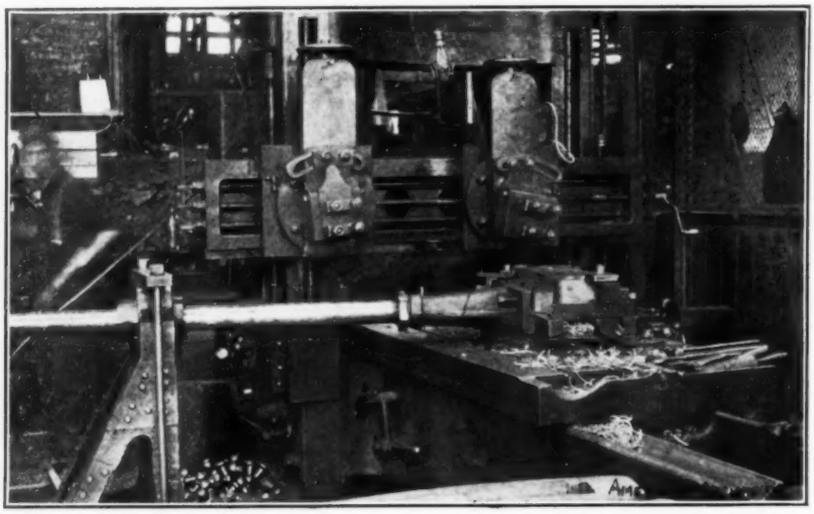


Fig. 3. Radius Planing Attachment

Hardening High Speed Steel Tools

By S. Thompson*

Some two years or more ago we started a screw-machine products business, which prospered from the very first and soon our customers were expressing satisfaction with our work, because we aimed at quality in our product. However, we found ourselves severely handicapped in not knowing the merits of different grades of tool steel, especially high-speed steels, and as we were especially in the screw-machine products business we used a lot of steel for forming tools.

Not being experienced in tempering high-speed steels, we were naturally

*Superintendent, Defiance Screw Machine Products Company, Defiance, Ohio.

afraid of the high heats, but about this time the tool-steel salesmen began to call on us and to them belongs largely the credit for what I know about tempering high-speed steels and also carbon steels, not to one individual salesman, but to all.

I, having been a shop man for almost twenty years and in such a position that I seldom met the traveling salesman, naturally felt that he was largely a pretense, but I have had my eyes and ears opened, for one has dropped a word here, another made a suggestion there, and these I have put together and I am now getting very excellent results hardening high-speed tools in a way that will be described as follows: My forge is small, bricked up well on the sides and one end. I use crushed foundry coke, letting the fire burn up pretty well, then I put my tool in the fire, covering it well all over, letting the draft force the fire to make it burn as it did before I disturbed it by putting in the tool. I next shut off the blast and leave the tool in the fire long enough to heat all the way through, the time depending on the size of tool, then making sure that my cutting edges or formed face is down, I put on the blast gradually, being sure that I have lots of fire under the tool so that the cold blast will not strike it, keeping it on until the tool is at about a white heat or close to 2100 degrees Fahrenheit. Now I turn the cutting edge away from the blast and keeping the tool covered with coke and also keeping the blast on, I tip the front end of the tool up about 10 degrees and make a hole through the coke so that I can see the under side of the tool; I watch carefully, the tool soon standing out nice and clean and looking like a piece of shaped snow, but before long it will commence to work or bubble; then I gradually shut off the blast, using about 15 seconds to do it and I let the tool stay in about five or ten seconds after the blast is off and then I plunge in kerosene with as little exposure to the air as possible (I use about twenty gallons of kerosene with about four quarts of lard oil), I cool the tool off entirely before removing from the bath and then polish and draw it to a straw color.

If at all possible I grind the tools all over, as the outside is always a little soft for about five or ten thousandths.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

Metal Working

NEW ENGLAND

The Worcester (Mass.) Metal Goods Company is to install a lacquering plant.

L. & J. A. Steward, Rutland, Vt., manufacturers of tin cans, are erecting an addition.

Fire completely destroyed the factory of the Holtzer-Cabot Electric Company, at Brookline, Mass. Loss, $200,000.

The Manufacturers Foundry Company, of Waterbury, Conn., will build an addition to its plant on Railroad Hill street.

Fred Provost has secured space in the Horn factory, Collinsville, Conn., where he will establish a garage and repair shop.

The Boston Pressed Metal Company, metal stamper, Worcester, Mass., is to expend $30,000 in doubling the capacity of its plant.

Plans have been prepared for a molding shop to be built by P. J. Flannery & Co., brass manufacturers, New Britain, Conn.

The United States Textile Machinery Company, Gardiner, Me., has been incorporated with $500,000. M. E. Heleston, president.

The Worcester Metal Goods Company, manufacturer of buckles and novelties, will build an addition to its plant at 17 Herman street, Worcester, Mass.

The Pneuvac Company, Boston, Mass., has been incorporated with $100,000 to manufacture vacuum cleaners by L. W. Brock, R. M. Merrit and O. J. Gleason.

Fire practically destroyed the plant of the H. A. Mathews Manufacturing Company, Seymour, Conn. The firm manufactures stove and metal trimmings. Loss, $75,000.

The Portland Terminal Company, which is controlled by the Boston & Maine Railroad, will issue $10,000,000 bonds to be used for enlarging the shops, new construction, etc., at Portland, Me.

The Hemphill Manufacturing Company, Gross street, Central Falls, R. I., is to erect a two-story addition to its present factory. Also a boiler house and forge shop will be constructed. Knitting machines are manufactured.

The Edison Company, Boston, Mass., has purchased a site and about $500,000 will be expended to take care of constructing and operating departments, which will include garage, machine shop and storerooms.

National Pin Company, of Derby, Conn., has been incorporated to make and deal in pins, hooks and eyes, etc. Capital, $200,000. Incorporators, Edward A. Harriman and S. Bigelow Cheney, both of New Haven, and Harold E. Drew, of Ansonia, Conn.

The American Manufacturing Company, Providence, R. I., has been incorporated with $10,000 for the purpose of buying, selling and manufacturing of all kinds of machinery. W. L. Frost and H. B. Frost, of Providence, and I. R. Morns, of Auburn, R. I., are incorporators.

MIDDLE STATES

The New York Central Lines are going to build car repair shops at Youngstown, Ohio.

A new machine shop will be built by the Park Drop Forge Company, of Cleveland, O.

A garage will be built by Thomas Britton, 2174 East Seventy-Ninth street, Cleveland, O.

The Mark Manufacturing Company, Zanesville, O., will build an addition to its machine shop.

The American Steel and Wire Company, Cleveland, Ohio, will make additions to its plant.

Fire destroyed William B. Reilly's blacksmith shop and carriage works, at Watervliet, N. Y. Loss, $2,500.

C. Morris, La Salle and Madison streets, Chicago, will add a machine shop to his plant and will buy new tools.

Fire damaged the factory of the Maxwell-Briscoe Automobile Company, Tarrytown, N. Y., to the extent of $10,000.

The Reeves Pulley Company, Columbus, Ind., will go into the manufacture of gasolene engines for general purposes.

The American Brass and Iron Company, general brass and iron founders, of Detroit, Mich., is erecting a new foundry.

The Atlantic Refining Company will build a garage to cost $7000 at Twenty-ninth and Passyunk avenue, Philadelphia, Penn.

The West Shore Railroad Company will enlarge its roundhouse, build an electric turntable and install a motor in its car repair shops at Ravena, N. Y.

The Ohio Tractor Manufacturing Company, Marion, O., manufacturing traction engines and farm machinery, is in the market for equipment.

The Interstate Stove Company, Cleveland, O., has been organized with $100,000 capital to manufacture line of stoves by R. V. Bussey and others.

The J. H. Day Company, Cincinnati, Ohio, building special machinery, will erect an addition to its plant on Harrison, near Colerain avenue.

The Comtograph, which is part of the Felt & Tarrant Company, has moved into its new shop on North Palina street, Chicago, and will add new tools.

The Hupp Corporation, of Detroit, Mich., manufacturer of the Hupp-Yeats electric automobile, is erecting a garage for the care and repair of its cars.

The Meyercord Manufacturing Company, Fifty-fourth avenue and Lake street, Chicago is to add a small machine and repair shop to plant and will install new tools.

The embroidery machinery plant of Robert Reiner at Gregory avenue and Hackensack Plank road, Weehawken, N. J., was destroyed by fire. Loss, $75,000.

A permit has been issued for the erection of a garage at Thirty-First and Thompson streets, Philadelphia, Penn., for Arnholt & Schaefer Brewing Company to cost $1700.

The Broadway Garage and Livery Company, Cleveland, Ohio, has been incorporated with $10,000 capital to operate a garage. Incorporators, F. Popecki, F. Puritowski and others.

The Automatic Register Company, Chicago, Ill., has been incorporated with $25,000 capital to manufacture and deal in machines and machinery by Asa G. Adams, D. S. Bobb, J. B. Wescott.

Plans are being prepared for an additional building for John Immel & Sons, Columbus, Ohio, to be used for the manufacture of electric trucks and for the repair and repainting of automobiles.

Andrew Kopperud, Madison and Barclay streets, Milwaukee, Wis., manufacturer of well-drilling machinery, will build a new plant at Lapham street and Thirty-Ninth avenue.

The Voting Machine Company, Hoboken, N. J. has been incorporated with $350,000 capital to manufacture voting machines. Incorporators, Samuel R. Sharp, J. George Fischer and R. C. Sharp.

The Acme Sheet Metal Company, Jersey City, N. J., has been organized to manufacture metal ceilings. Capital, $50,000. Incorporators, M. C. Duane, N. E. Wiggins, Geo. W. Everitt.

The Frank A. Reeve Company, Montclair, N. J., has been organized with $30,000 capital to manufacture motor cars. Incorporators, Frank A. Reeve, John A. Butler, David B. Slayback.

New equipment for machine shop, hammer shop and forge shop will be required by the Pollak Steel Company in connection with the improvements contemplated at its plant at Carthage, O.

The Burke Valve Company, Cleveland, Ohio, has been organized with $50,000 capital to manufacture and sell valves and valve parts for pumps by W. B. Burke, Tracy H. Duncan, Wm. G. Rose, etc.

The Imperial Brass Company, Canal and Harrison, Chicago, has a new shop and foundry nearly completed at Thirty-eighth Place and Rockwell street, and will be in the market for a new outfit of machine tools.

The Dean Manufacturing Company, Newport, Ky., has increased its capital from $100,000 to $150,000 and will build motors for aeroplanes. The plant will be improved and new equipment required.

The Thompson Electric Company, Warren, Ohio, has been incorporated to manufacture and sell all kinds of electric apparatus by Allison J. Thompson, Joseph Hidy, Joseph E. Klein, etc. Capital, $10,000.

The Electric Signal and Engineering Company, of Alliance, Ohio, has been incorporated to manufacture several patented appliances for signaling and will need equipment. D. C. Schultz, principal stockholder.

The Ackley Brake and Supply Company, New York, has been incorporated to manufacture brakes for street railways. Capital, $50,000. Incorporators, G. S. Ackley, J. C. Raymond, Hudson Terminal building, etc.

Four car-repair shops will be built by the Cincinnati Traction Company at Winton place, Cincinnati, O., bids for the construction of which will be advertised in the near future. New equipment will be required.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids October 31 for one radial boiler plate drill, one power press, one punch and riveter (schedule No. 4005), three drill presses (schedule No. 4003).

The Handy Light Company, Cincinnati, Ohio, has been incorporated to manufacture and sell electric apparatus of all kinds. Incorporators, Stanley B. Frieburg, Leonard H. Frieburg, Thomas B. Matthews, etc. Capital, $25,000.

The Joseph Bardsley Manufacturing Company, Jersey City, N. J., has been incorporated with $30,000 capital to manufacture hardware specialties. Incorporators, Edwin F. Britten, Jr., William T. Wright, Thomas F. Meaney, Jr.

The Palmer File and Drill Company, New York, has been organized to manufacture tools, implements, etc. Capital, $50,000. Incorporators, K. A. Words, 373 Sixth avenue, Brooklyn. R. M. Richter, 653 East 164th street, New York City.

The West Bend (Wis.) Aluminum Company has been organized by Andrew J. Pick, Edwin Pick, Martin Walter and others. They have secured old knitting mill property on Division street and will equip the same for the manufacture of aluminum ware.

The Heater Muffler Company, Elmira, N. Y., has been organized to manufacture appliances for motors, engines and automobiles. Capital, $50,000. Incorporators, W. Kinzie, 401 Euclid avenue, L. D. Curran, 315 West First street, A. G. Ingham, 508 E. Market street, all of Elmira.

SOUTHERN STATES

A garage and automobile show building will be erected by the Brown Taxicab Company, Baltimore, Md.

The Missouri, Kansas & Texas Railway Company will erect a new station and extensive shops at Waco, Tex., to cost $350,000.

The Kuhner Engine Company, Oxford, Md., has been formed to manufacture stationary and marine engines. H. E. Kuhner will be manager.

Fire destroyed the Richmond (Va.) branch plant of the International Harvester Company, causing about $300,000 loss to machinery and stock.

The Galey Nut Lock Company, Jackson, Tenn., has been incorporated to manufacture bolts, locks, keys, etc. Capital, $100,000. Incorporators, W. F. Lamb, W. T. Peter, J. D. Newton, etc.

The Southern Pacific railroad will, it is understood, purchase a site of 150 acres near Lafayette, La., to erect new shops. The large repair shops at Algiers, La., will also be moved to Lafayette.

Articles of incorporation were filed in Dover, Del., for the Cigar Machine Corporation of America. Capital, $5,000,000. A plant will be erected where machines for the manufacture of cigars will be made. An office of the company has been established in the Continental Trust building, Baltimore, Md.

WEST OF THE MISSISSIPPI

Mr. Gulbrouson, of Winnebago, Minn., will erect a blacksmith shop.

David Krick, of Caledonia, Minn., will erect a modern blacksmith shop.

Adolph Scheuerman will build a new blacksmith shop at Oskaloosa, Iowa.

J. H. Kirkpatrick is preparing to build a blacksmith shop at Owasa, Iowa.

The Liberty Foundry Company, St. Louis, Mo., will erect new foundry building.

The Churchill Automatic Electric Clock Company, Pueblo, Colo., will erect a factory.

The plant of the Hay Tool Company, at Council Bluffs, Iowa, was damaged by fire. Loss, $5000.

Contract has been let by the Midland Valley Railway for construction of $12,000 round house at Wichita, Kan.

A. G. Dodge Los Angeles, Cal., contemplates the erection of an aluminum working plant near Elsinore, Cal.

J. T. McCormick, San Francisco, Cal., has taken out a permit to build a new bronze foundry on Cleveland street.

Dunning & Erich, Harrington, Wash., operating a harvester-manufacturing plant, will build a new foundry addition.

H. Geilfuss, Fulton street, San Francisco, Cal., is having plans prepared for a commercial garage and repair plant.

Craig & Selle, Toppenish, Wash., plan for the erection of a plant for the manufacture of pumps and farm machinery.

The St. Joseph (Mo.) Plow Company will reorganize under the name of the Swanson-St. Joseph Plow Company, and increase output.

W. S. Chase & Co., of San Diego, Cal., have taken out a permit to build an addition to their commercial garage and repair plant.

W. B. Kyle, San Francisco, Cal., is having plans prepared for a commercial garage and repair plant to be erected at Klamath Falls, Ore.

The Board of Education, Santa Barbara, Cal., will build a machine-shop addition for the manual-training department of the city high school.

M. Fisher, San Francisco, Cal., has acquired a site on Golden Gate avenue, and plans for the erection of a commercial garage and repair plant.

Harry Butler, Grass Valley, Cal., plans for the erection of a commercial garage and machine shop at Yuba City, Cal. Modern equipment will be installed.

The Smith Garage Company, La Grande, Ore., has acquired property on Fifth street, and plans for the erection of a commercial garage and repair shop.

O. L. Lance, Corvallis, Ore., is at the head of a company which plans for the establishment of a plant for the manufacture of a patented railroad switch.

The Atlas Metal Works, Dallas, Tex., have sold the building now occupied by them at Young and Marilla streets and will erect a large modern plant on a site to be procured.

The Sugarman Iron and Metal Company, San Francisco, Cal., has acquired property on Brannan street, and is said to be contemplating the erection of an addition to its plant.

The Southern Pacific Railroad will install additional machinery at its roundhouse, Santa Barbara, Cal. The plant is now building at a cost of $100,000 and will be fully equipped.

The United Properties Company, San Francisco, Cal., operating electric railway systems, has acquired property at Richmond, Cal., and is said to be planning for the erection of car shops.

The Board of Education, Los Angeles, Cal., plans for the erection of a new school in the Boyle Heights district. A machine shop, fully equipped for manual-training work, will be installed.

The S. & D. Motor Vehicle Company, Oakland, Cal., recently incorporated, is planning for the erection of a plant for the manufacture of automobiles. Carlos Schmidt is head of this company.

The Herrick Edman Construction Company, Venice, Cal., has been granted permission to build a plant for the manufacture of aëroplanes on Windward avenue. About $25,000 will be expended.

The Pacific Vending Machine Company, Seattle, Wash., has been organized with a capital of $30,000 to manufacture a patented vending machine. A. L. Delkin and Harry Suver are interested.

The Busch-Sulzer Brothers Diesel Engine Company, with offices in the South Side Bank building, St. Louis, Mo., has decided to erect a plant in St. Louis for the manufacture of the Diesel oil engine.

The Boenker Motor Plow Manufacturing Company, St. Charles, Mo., has been incorporated with $24,000 capital to manufacture motor plows. Incorporators, H. H. Boenker, Louis Ringe and J. C. Wilbrand.

The California Pipe Line Machine Company has been incorporated at San Francisco, Cal., by J. J. and P. H. Mahoney and W. L. Norris, with a capitalization of $20,000. The business will be established at San Francisco.

A shop addition, fully equipped, will be installed in connection with the new high-school buildings to be erected by the Board of Education, Santa Monica, Cal. Allison & Allison, architects, Los Angeles, are preparing plans.

The Enterprise Foundry Company, San Francisco, Cal., has acquired a site of 20 acres at Richmond, Cal., and plans for the erection of a large foundry plant. About 600 men will be employed. J. W. Heany is secretary of this company.

The Eureka Motor Company, Seattle, Wash., has been acquired by H. L. Solnave. The plant will be conducted as a commercial garage and machine shop and will be fully equipped to handle all repair, cylinder grinding and gear-cutting work.

The Eclipse Wheel Manufacturing Company, Seattle, Wash., has been incorporated by I. J. Merrill and C. A. Benbow, with a capital stock of $250,000. The company plans for the erection of a plant for the manufacture of its specialty; a machine shop is included.

The Savage Tire Company, San Diego, Cal., recently incorporated, is having plans prepared for a large plant on Twenty-Sixth street for the manufacture of a patented steel tire. Heavy machinery, finishing machinery, foundry and furnace equipment will be installed. About $175,000 will be expended. Quayle Brothers, architects, San Diego, are preparing plans. Arthur W. Savage is head of this company.

CANADA

The E M F Automobile Company is doubling its plant at Walkerville.

The Canadian Pacific Railroad will equip new shops at Calgary, Alberta.

The Clinton Motor Car Company will equip a new plant at Clinton, Ont.

The Copp Stove Company will equip a new plant at Fort William, Ont.

The Petrolea Automobile Company is building a new plant at Petrolea, Ont.

The American Vacuum Cleaner Company will locate a new branch factory.

The Jules Motor Company, of Guelph, will equip a new plant at Guelph, Ont.

The Defferies Woodman Company will locate a new silverware factory at Alliston, Ont.

The Canadian Motors Company, of Galt, will build an addition to its factory.

The Canada Steel Foundries Company will build additions to its plant at Welland, Ontario.

The harbor commissioners will spend $80,000 equipping a repair shop and engine house at Montreal.

The Hall & Zoyd Company will make a big extension to its foundry and plant at Hespeler, Ont.

The McLaughlin Carriage Company will make big extensions to its Winnipeg garage and install new machinery.

The Dominion Stamping Company, manufacturer of auto accessories, is building an addition to its factory at Walkerville, Ont.

GENERAL MANUFACTURING

NEW ENGLAND

Thos. W. Gardiner, Lynn, Mass., is to erect a new three-story last factory.

Concord, Mass., will issue $12,500 bonds for improvements to its water system.

The Lowell Textile School, Lowell, Mass., will build a power house to cost $20,000.

Mintell Bros., Darlington, R. I., are to operate a new paper manufactory in that town.

An addition will be built to the Agawam No. 2 Paper Mill at West Springfield, Mass.

Fire destroyed the factory of the Eastport Sardine Company, Eastport, Me. Loss, $40,000.

The Emerson Shoe Company, Rockland, Mass., contemplates another addition to factory.

A yarn-dyeing plant is to be erected at the plant of the Samoset Company, Valley Falls, R. I.

E. T. Wright & Co. have drawn plans for a large addition to their shoe factory at Rockland, Mass.

The Ponds Extract Company, Middletown, Conn., will erect a new boiler house and engine room.

The plant of the Worcester (Mass.) Bleach and Dye Works, was almost destroyed by fire. Loss, $100,000.

The United States Finishing Company, of Norwich, Conn., will build a new three-story factory building.

The lumber mill of Roscoe Hart, Canaan, Me., was destroyed by fire, causing a loss of several thousand dollars.

Two large sawmills of the James Murchie Lumber Company, Calais, Me., were destroyed by fire. Loss, $25,000.

The H. H. Brown Shoe Company, North Brookfield, Mass., will install an electric-lighting plant at its factory.

The Russell Company, at South Farms, Middletown, Conn., will build a three-story addition to its weaving mill.

E. A. McMillin & Co., North Adams, Mass., manufacturers of paper boxes, will erect an addition to its plant on Chestnut street.

The New England Telephone and Telegraph Company, at Lowell, Mass., is to erect a new building of the most modern type.

The Bowler Brothers, Ltd., Worcester, Mass., will build an addition to its bottling plant on Ellsworth street to cost $13,000.

Work has been started on an addition to the paper-box factory of E. A. McMillin & Co., on Chestnut street, North Adams, Mass.

The old Farwell Comb factory, Northboro, Mass., has been purchased by the Peerless Celluloid Company, who will manufacture a similar line of goods.

The Southern New England Telephone Company has purchased a site on High street, Willimantic, Conn., where it will erect a telephone exchange building.

R. S. Brown will build an addition to his leather and binder board factory in Willimantic, Conn., which will double the capacity of the dyeing department.

The Springfield Gas Light Company will erect a coke-storage plant on Water street, Springfield, Mass., same to be equipped with conveyers and handling apparatus.

A building, containing heating and lighting plant, laundry, bakery, carpenter shop and printing shop will be built in connection with the Perkins Institute at Watertown, Mass.

The large woolen mills of A. Howarth & Son, Rockdale, Mass., which have been idle two years, have been purchased by American Woolen Company, which contemplates operating them.

The Hartford Packing Box Company, Hartford, Conn., has been incorporated to make boxes, deal in lumber, etc. Capital, $25,000. Incorporators, Amos O. Springer, Henry W. Seide and Solomon Elsner, all of Hartford.

The M. De Santo Company, New Haven, Conn., has incorporated with $10,000 capital to operate a grist mill. Incorporators are Michele De Santo and J. Grant Sewell, of New Haven, and Alfred E. Schuster, of West Haven.

The Charles C. Howe Lumber Company, of Lowell, Mass., has been sold to George C. Leavitt, who will continue the business under the name of the Leavitt Commission and Storage Company. Plans have been made for enlarging and increasing the capacity of the business.

MIDDLE STATES

Fire destroyed power plant at cannery of Lonech Sons, Gowanda, N. Y.

The Hamilton Rubber Company, Trenton, N. J., is erecting a three-story addition.

The Standard Oil Company, at Cleveland, Ohio, will build a new pump house.

The town of Ferdinand, Ind., is planning to build a modern waterworks plant.

The Postage Rubber Company, Barberton, O., will make improvements to its plant.

A boiler will be installed in the William E. English power plant, Indianapolis, Ind.

The Robinson & Albright Packing Company, Marysville, O., will build a new plant.

The American Box Company, of Cleveland, Ohio, is erecting a new factory and power house.

The power plant of the Laughlin Tin Mill, Bridgeport, O., was partly wrecked by an explosion.

The Iroquois Brewing Company will erect a $15,000 addition at 212 Pratt street, Buffalo, N. Y.

The power plant of the Metropolitan Railroad Company, Chicago, was wrecked by a gas explosion.

The paper-box plant of Emanuel Weil & Co., of Philadelphia, Penn., was partially destroyed by fire.

J. A. Long, of Portland, Ind., will build a four-story cold-storage and ice plant at Winchester, Ind.

The plant of the National Pickling and Canning Company, Knox, Ind., was destroyed by fire. Loss, $20,000.

Contracts will be let shortly by Bertsch & Co. for traveling cranes for their new plant at Cambridge City, Ind.

The Utica Knitting Company has awarded the contract for building a factory and boiler house at Sherburne, N. Y.

The Bishop-Babcock-Becker Company, makers of soda fountains, etc., Cleveland, Ohio, will erect a large power house.

The canning plant of George W. Stradley, in Laurel, Del., was destroyed by fire. Loss, $20,000. The plant will be rebuilt.

The Wabash Pottery Company, of Roseville, Ohio, has increased its capital and is planning numerous improvements.

William Wenkenbach's Sons, wagon makers, will build a two-story factory at 1311 to 1315 Orianna street, Philadelphia, Penn.

The Lake Shore & Ishpeming railroad is constructing one of the largest ore docks on the Great Lakes, at Marquette, Mich.

The Lorenze Knit Goods Company, Chicago, has started erection of factory and will instal new machinery, including engine and boilers.

Rand & McNally Company is erecting a 16-story building at Clark and Harrison streets, Chicago, Ill., which will be equipped with power plant.

The Muncie Ice Company, Muncie, Ind., is tearing down its old factory and will construct a new ice plant of much larger capacity.

The Spring Valley Mining Company, of Iron, Mich., is erecting a new boiler house, shaft house and other buildings at Zimmerman, Mich.

The G. J. Brethauer Planing Mill Company will build a new five-story mill in addition to its present plant on Bogan street, Cincinnati, O.

The Pioneer Canning and Manufacturing Company, St. Henry, Ohio, has increased its capital and will add new equipment to its canning plant.

The Pittsburg Plate Glass Company has bought the plant of the Ohio Glass Company, at Toledo, Ohio. Will enlarge same and increase output.

M. A. Fee and E. A. Steinbrecker, of Manitowoc, Wis., are promoting the erection of a milk-condensing factory to cost $150,000 at Kaukauna, Wis.

Victor Manufacturing and Casket Company will build a two-story factory at 1954-56 South Troy street, Chicago, and put in a complete new of woodworking machinery.

It is announced that Muench Sons' tannery, at Gowanda, N. Y., which was recently burned, entailing a loss, including the power plant, of about $70,000, will be rebuilt at once.

Plans have been completed for an addition to power plant of factory at Twenty-first street and Washington avenue, Philadelphia, Penn., recently purchased by Litt Brothers.

The Federal Shoe Company, Cincinnati, Ohio, has been incorporated with $250,000 capital to manufacture shoes by Morris L. Bangham, Clyde M. Skillman, W. M. Berry, etc.

The Delaware Steam Laundry Company, of Delaware, Ohio, has been incorporated to do a general laundry business and will need equipment. F. M. Murray, principal stockholder.

The Garland Refining Company, Cleveland, Ohio, has been organized to manufacture and deal in paints, oils and petroleum by E. L. Geismer, A. J. Halle, M. Kluger, etc. Capital, $50,000.

A permit has been issued for the erection of a factory on Auburn street, east of Trenton avenue, Philadelphia, Penn., for Henry Holmes & Sons, carpet manufacturers, to cost $12,500.

The Cleveland (Ohio) Cooperage Company has been incorporated to manufacture and deal in cooperage of all kinds by John Hirsins, Alexander J. McCrea, John Beck, etc. Capital, $60,000.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids October 31 for one ripping and resawing machine, one double cylinder surface as per schedule No. 3998.

The Board of Fire Underwriters is building a 20-story building, to be known as the "Insurance Exchange Building," at Jackson boulevard and Fifth avenue, Chicago, and will install a complete power plant.

The Radium Glass Company, Millersburg, Ohio, has been organized with $50,000 capital to manufacture and sell pressed and blown glassware by S. B. Fair, John W. Fenton, Carl Schuler, etc.

Fire that destroyed a large planing mill and much lumber at the plant of the Westchester Lumber Company, at Westchester avenue and Unionport road, Bronx borough, New York City, did damage approximating $60,000.

Bids will be received at the office of the Director of Public Service, 104 City Hall, Cleveland, O., until October 24, 1911, for pumping machinery for a fire-service pumping station. Specifications may be obtained of the superintendent of the water department.

SOUTHERN STATES

Roseland, La., voted $21,000 bonds for waterworks.

Amory, Miss., voted $65,000 bonds for waterworks and sewers.

Cumberland, Md., will issue $100,000 bonds for improvements to its water system.

Dayton, Tenn., will issue $25,000 bonds for improvements to its waterworks system.

Grafton, W. Va., will issue $90,000 bonds for improvements to its water system.

The Davison Chemical Company is planning to erect a large addition to its plant in Curtis Bay, Md.

Selma, N. C., will spend $20,000 for improvements to its electric-light plant and waterworks.

The Parkersburg (W. Va.) Ice and Coal Company has commenced work on a new cold storage plant to cost about $50,000.

The National Brewing Company will erect an addition to its plant in Canton, Baltimore county, Md., to cost $45,000.

The Elmville Worsted Company, Killingly, Conn., has incorporated with $50,000 capital to manufacture woolen yarns.

The Howe Ice Company, Nashville, Tenn., will increase the capacity of its local plant and also erect a new plant at Atlanta, Ga.

The candy factory of the Henry Pfeil Manufacturing Company, 559-565 Robert street, Baltimore, Md., was partly destroyed by fire.

The Strathmore Paper Company contemplates the installation of a hydroelectric power plant for furnishing power for its mills at Mittineague, Mass.

Loreauville, La., will receive bids until November 15, for the construction of waterworks. Address Paul Bassin, tax collector, Box 23, Loreauville, La.

The Gilbert & Barker Manufacturing Company, Springfield, Mass., manufactur of fuel and gas furnaces, which will erect a new plant in West Springfield, Mass., will require power-plant equipment, including a 300-horsepower boiler and a 125-horsepower engine. A coal pocket will also be constructed.

WEST OF THE MISSISSIPPI

Westville, Okla., voted $29,500 bonds for waterworks.

Jordan Brothers, of Sioux Falls, S. D., will build a planing mill.

Kerfoot Brothers, Corcoran, Cal., plan to install a new pumping plant.

Platt Brothers' tile factory at Van Meter, Iowa, was destroyed by fire.

The What Cheer (Iowa) Pottery Company will erect a large plant this fall.

Z. A. and P. J. Cye will build a tile and sewer-pipe factory at Litchfield, Minn.

The lumber plant of the Astoria (Ore.) Box Company was partially destroyed by fire.

The Prosser (Wash.) Ice and Cold Storage Company will build a new creamery plant.

The Farmers Creamery Company, of Fort Rice, N. D., has secured a site for a plant.

F. E. Ployhar, of Valley City, N. D., has been granted a franchise to install a gas plant.

The city of Aberdeen, Wash., contemplates the erection of a municipal electric-lighting plant.

The city of Dufur, Ore., contemplates the installation of a municipal electric-lighting plant.

The Puyallup Veneer and Mill Company's plant was burned at Puyallup, Wash. Loss, $90,000.

The plant of the Midvale (Ida.) Telephone Company was partially destroyed by fire. The plant will be rebuilt.

The Snow-Moody Development Company, Ontario, Ore., will build an electric pumping plant on Snake river.

The Robinson Fisheries Company, Anacortes, Wash., contemplates the erection of a new fish-packing plant.

Cooper Brothers, Salt Lake City, Utah, contemplate the erection of a large flour milling plant at Pocatella, Ida.

The Independent Telephone Company, Vale, Ore., plans to install a plant and system in Vale and adjacent districts.

The Chehalis River Lumber and Shingle Company, Lincoln, Wash., will build a new sawmill and planing mills.

The Everett (Wash.) Gas Company contemplates extensive improvements in its lighting system at Snohomish, Wash.

The Santa Barbara (Cal.) Gas and Electric Company is planning for additions in its gas system, near Montecito.

The city of Riddles, Ore., is planning to install a waterworks system and a sewerage system. Bonds will be voted.

The Holland Cook Manufacturing Company will erect a plant to manufacture columns and boxes at Tacoma, Wash.

The Inspiration Copper Company, Globe, Ariz., will build a new pumping plant for its water system near Wheatfields.

L. B. Case, Redlands, Cal., has taken out a permit to build a fruit-packing plant. Modern equipment will be installed.

W. F. Byram & Sons, Ione, Wash., plan for the erection of a large shingle mill plant. The plant will be fully equipped.

The Empire Ice and Shingle Company, Spokane, Wash., is planning to rebuild its shingle plant, recently destroyed by fire.

The Apex Canning Company, Anacortes, Wash., fish canners, has commenced the erection of an addition to its plant.

The Mullan (Ida.) Electric Light and Power Company is planning for the erection of a new plant on Second street.

Lewis & Sons, Central Point, Ore., meat dealers, are planning for the erection of a modern ice anod cold-storage plant.

The Brundin Packing Company, at Albert Lea, Minn., will have an addition built. New refrigeration plant will be installed.

J. A. Vecta, Cœur d'Alene, Ida., will establish a plant for the manufacture of shoes. modern ice and cold-storage plant.

The Hamilton (Ore.) Beet Sugar factory contemplates the erection of a new sugar-manufacturing plant at Merrill, Ore.

The Livegreb Lumber Company, Forest Grove., Ore., is planning for the erection of a large sawmill and lumber plant.

The Seneca Mining and Milling Company, Greenville, Cal., contemplates the erection of a power plant on the Feather river.

The Winnemucca (Nev.) Water and Light Company will build a new power plant. Ground has been broken for the erection.

J. P. Grimes, Anderson, Shasta county, Cal., plans for the erection of a creamery plant. Modern machinery will be installed.

The Maricopa-Visalia Oil Company, Maricopa, near Bakersfield, Cal., will install new drilling machinery and boiler equipment.

The National Sewer Pipe Company, of Webster City, Iowa, will erect a $250,000 plant at Lawn Hill, Webster City, Iowa.

The Bullion Copper Company, near Murray, Ida., is planning for the installation of a new air compressor and hoisting plant.

The planing mill of the Ainsworth Lumber and Mill Company, Orange, Cal., was destroyed by fire. Loss estimated at $10,000.

The Rocky Mountain Elevator Company, Great Falls, Mont., is planning for the erection of a grain elevator plant at Ulm, Mont.

The Hygeia Ice Company, Salt Lake City, Utah, has taken out a permit to build a new ice-manufacturing plant on East Sugar avenue.

The Washington-Oregon Corporation, Chehalis, Wash., is planning to install lighting and power systems at Littell and Adna, Wash.

The lumber plant of the Calpenham Lumber Company, Kapowsin, Wash., was destroyed by fire. Loss estimated at $50,000.

The city of Honeyville, near Brigham City, Utah, has voted bonds for $12,000 for a small waterworks and electric-lighting system.

The city of Whittier, Cal., is planning to install new pumping machinery at its water plant. The city clerk will soon advertise for bids.

The American Beet Sugar Company, Garden City, Kan., contemplates the erection of a beet-sugar manufacturing plant near Portales, N. M.

The Pittsburg (Penn.) Enamel Works has acquired a large tract of land at Newark, near Oakland, Cal., and plans for the erection of a plant.

Moran & Co., San Francisco, Cal., meat packers, has leased property at Sacramento, Cal., and will establish a branch packing plant.

The Los Angeles (Cal.) Railway Company has taken out a permit to build a new boiler plant at its car barns on East Fifty-Third street.

The Globe Grain and Milling Company, Los Angeles, Cal., is planning for the erection of a branch plant at El Centro, in the Imperial valley.

The plant of the Coss Bay Eagle Brewing Company, Marshfield, Ore., was destroyed by fire. Machinery, for the greater part, was ruined.

The Vancouver (Wash.) Packing Company has been incorporated to establish a meat-packing plant. Modern equipment will be installed.

The lumber and woodworking plant of the Puyallup (Wash.) Veneer and Mill Company was destroyed by fire. Loss estimated at $90,000.

Charles C. Ross, Portland, Ore., has commenced the erection of a new creamery plant at Goldendale, Wash. The plant will be fully equipped.

The Tacoma (Wash.) Gas Company plans for extensive improvements and additions in its plant and system. About $1,000,000 will be expended.

The Modoc County Irrigation Company, Cedarville, Cal., is planning for the erection of an electric power plant near Cowhead lake, Modoc county.

The Bend (Ore.) Water, Light and Power Company plans for extensions in its water and electric-lighting plants. A franchise has been granted.

The Sierra Light and Power Company, Corona, Cal., plans for improvements and additions in its plant and system. Plans are being prepared.

The Hydro-Electrical Company, Hood River, Ore., is planning to install a lighting and power system at The Dalles, Ore. A franchise has been asked.

The plant of the Northwestern Lumber Company, at Kalispel, Mont., in which C. J. Winton & Son, of Minneapolis, are interested, was burned. Loss, $100,000.

The Glendora Heights Orange and Lemon Association, Glendora, Cal., plans for improvements and additions in its fruit-packing plant. New equipment will be installed.

The Utah & Salt Lake Canal Company, Salt Lake City, Utah, plans to install new pumping machinery on the Jordan river. Peter Larsen is president of this company.

The Mount Hood Railway and Power Company, Portland, Ore., has an option on a power site on the Lewis river, and contemplates the erection of a new power plant.

The Vaughn-Middleton Company, Los Angeles, Cal., has acquired property on Compton avenue, Los Angeles county, and contemplates the installation of a water pumping plant.

The Gem Irrigation Company, Caldwell, Ida., is planning to install a number of pumping plants on the Snake river. T. B. Garrison, Portland, Ore., is interested in this company.

The Long Beach (Cal.) Sash and Door Company has had plans prepared for a new sash and door-manufacturing plant on Second street. The plant will be fully equipped.

The Wisconsin Lumber Company, Littell, Wash., plans to increase the capacity of its lumber-working plant and install new equipment. A bond issue of $175,000 has been voted for this work.

The Pacific Vegetable Company, Los Angeles, Cal., has taken out a permit to build a new vegetable packing plant on Santa Monica avenue. Modern equipment will be installed.

The Hill-Thorne Investment Company, Los Angeles, Cal., plans for the erection of a powder-manufacturing plant near Everett, Wash. The Everett Chamber of Commerce is interested.

The Vacuum Ice Company, Sacramento, Cal., has been incorporated by C. S. Ralph and A. L. Chaufet, with a capital of $50,000. The company plans for the erection of an ice and cold-storage plant at Sacramento.

The Onyx Marble Company, near Chelan, Wash., contemplates the erection of a marble-working plant on its deposits, for grinding, cutting and polishing. H. B. Waite, Seattle, Wash., is interested in this company.

The Eastern Oregon Coöperative Telephone Association, Elgin, Ore., has been organized to install a telephone plant and system at Elgin. Construction will be started at once. William Parks is president of this association.

The Calistoga (Cal.) Electric Company, recently organized, plans for the construction of a power-distributing system from Bale, into the Napa Valley district. D. R. Wedamand and C. W. Crouch are interested in this company.

As provided for in the annual police budget, by the city council, Los Angeles, Cal., the city is planning to install an electric rock-ershing plant at the East Side jail building. Police Captain Lehnhausen is interested.

Power-plant equipment will be installed in the new University hotel to be erected at San Francisco, Cal., by W. B. Hammon and others. The structure is estimated to cost $500,000. Willis Polk & Co., architects, San Francisco.

The Holl & Cook Manufacturing Company, Tacoma, Wash., has commenced the erection of a plant for the manufacture of boxes and wood specialties, near Bismarck, Wash. The plant will be fully equipped and is estimated to cost $50,000.

The Bentley (Ore.) Telephone Company has been incorporated by D. S. Bentley and W. F. Schaad. The company plans to install a plant and system in Polk, Yamhill and Lincoln counties. Headquarters will be established at Bentley.

The Fort Jones (Cal.) People's Creamery Company, recently organized, plans for the erection of a modern creamery plant, equipped for the manufacture of ice, condensed milk, and creamery products. E. W. Pereira is head of this company.

The Great Northern railway plans for the erection of a plant at Everett, Wash., for the manufacture of passenger cars, including upholstering and interior-finishing work. The plant will adjoin the company's shop buildings, now in course of construction.

The Port of Portland Commission, Portland, Ore., has authorized the construction of a 30-inch suction dredge for harbor work. The dredge will be completely equipped and is estimated to cost $225,000. J. B. C. Lockwood, engineer, has prepared plans.

The Wasco Warehouse and Milling Company, The Dalles, Ore., will soon commence the erection of a new flour-milling plant to cost $125,000, exclusive of machinery. The plant will have a capacity of 2000 barrels per day and will be completely equipped.

The Pacific Power and Light Company, Portland, Ore., plans to extend its power system from Husum to Underwood, Wash. A franchise has been asked. The company will build a new power plant at North Yakima, Wash. Contract for the building has been awarded.

The Rogue River Lime Company, Grants Pass, Ore., has been organized to take over the properties of the Grants Pass Marble and Lime Company. A large plant for the manufacture of lime and kindred products will be erected, and will be fully equipped. S. B. Gorbutt, Portland, Ore., is head of this company.

The Deschutes River Rimrock Power Company, Portland, Ore., has been incorporated with a capital of $1,000,000 and plans for the erection of two power plants on the Deschutes river, of 15,000 and 65,000 horsepower capacity, respectively. M. A. Moody, The Dalles, Ore., is president; Le Roy Park, Portland, is secretary.

The Los Angeles (Cal.) China Manufacturing Company, recently incorporated, is having plans prepared for a plant for the manufacture of china products at Dominguez, near Los Angeles. About $60,000 will be expended in the erection of buildings and the plant will be fully equipped with machinery. C. P. Railsback is head of this company. E. G. Taylor, architect, Los Angeles, is preparing plans.

CANADA

The Brandon Steam Laundry Company will double its plant.

Vermilion, Alberta, will purchase new electric lighting machinery.

Beachville, Ont., will install hydro power and equip a new substation.

The Aylmer Canning Company will double its plant at Aylmer, Ont.

Swift Current, Saskatchewan, will install a new water-works system.

Lethbridge, Alb., will add a 1000-kilowatt unit to its municipal plant.

The Monarch Knitting Company, of St. Thomas, Ont., will double its plant.

The Lea Pickling Company will equip a large new factory at Simcoe, Ont.

Galt, Ont., will extend its water-works plant and new machinery will be required.

The Pickering Patent Wheel Company will locate a new factory at Montreal.

The Automatic Woodturning Company will double its factory at St. Romauld, Que.

The Renfrew Power Company, of Renfrew, Ont., will install a complete new plant.

The Vancouver Marble and Tile Company will equip a new plant at Vancouver, B. C.

The St. Catherines Broom and Brush Company will locate a branch factory at Calgary, Alb.

The Manitoba White Granite Pressed Brick Company will locate a big new plant in Winnipeg.

The Brandon Electric Light Company, of Brandon, Man., will build an addition to its plant.

The Canadian Light and Power Company, of Montreal, will make extensions to its plant.

The William Rutherford & Sons Company will equip a big new printing plant at Montreal.

The Southam Printing and Lithographing Company will equip a big new plant at Simcoe, Ont.

The Similkameen Power Company will equip a big development plant near Vancouver, B. C.

The Windsor, Essex & Lake Shore Railway, head office Windsor, Ont., will buy new locomotives and equipment.

Moirs Manufacturing Company, makers of high grade chocolates, will build a new $150,000 factory at Halifax, N. S.

The planing mill of the O'Laughlin Lumber Company, at Brantford, Ont., was completely wiped out by fire. Will be rebuilt at once.

The St. Thomas Packing Company, of St. Thomas, Ont., is building a big addition to its plant and will install the latest equipment.

The Canadian Pacific railroad will purchase equipment for the development of power at a plant it will locate at Adams River, near Vancouver, B. C.

MINING

The Atlas Wonder mine, Wonder, Nev., contemplates the erection of a new milling plant.

The Rio Plata Mining Company, Chihuahua, Mex., plans to install new operating machinery.

The Kickard Brothers, operating at Mount Grant, Yerington, Nev., plan to install a five-stamp mill.

The Phœnix Mining Company, Virginia City, Nev., contemplates the erection of a new milling plant.

The Wettlaufer Mining Company, Salt Lake City, Utah, plans to install a concentrating plant at its property.

The I. P. Noel mine, near Wenden, Ariz., plans for the erection of a stamp mill. M. E. Griffith is head of this property.

The Clipper Mills mine, Oroville district, Butte county, Cal., contemplates the installation of new operating machinery.

The San Rafael mines, Pachuca district, Mex., plan for the erection of a cyanide plant on the Los Remedios property.

A. C. Werden, Kingman, Ariz., contemplates the erection of a milling plant on his properties in the Gold Road district.

The Melvin mine, Shoshone district, Nev., will install a new milling plant. S. P. Tillman is interested in this property.

The Talno mines, Parral district, Mex., plan to increase the capacity of their milling plant. New equipment will be installed.

The Culling mine, near Wenden, Ariz., will install new operating and crushing machinery. Charles D. Mayers operates this property.

The Cascade Falls Mining Company, of Victoria, B. C., will buy new machinery for properties it is developing in British Columbia.

The Cuyahoga Iron Company, of Cleveland, Ohio, has acquired the Victoria property at Crystal Falls, Mich., and will open mines there.

The Corrigan-McKinney Company, the largest operators in the Crystal Falls mining district in Michigan, are to open a new mine shortly.

The Penn-Sonora Mining Company, operating near Nogales, Ariz., will install new operating machinery. B. H. Howard is interested in this property.

The Alvarado Mining and Milling Company, Parral district, Mex., operating the Palmilla mine, will double the capacity of its milling plant.

The Southwestern Mines Corporation, Terrazas district, Chihuahua, Mex., plans for the erection of a large cyanide plant. G. W. Boyce is manager.

The Ray Consolidated Copper Company, Ray, Ariz., plans to install a full equipment of new drilling machinery. About 125 machines will be required.

The Shattuck-Arizona Mining Company, near Bisbee, Ariz., plans for the erection of a smelting plant at Douglas, Ariz. Mr. Shattuck is head of this property.

The East Pacific mine, Winston, Mont., contemplates the installation of new milling machinery. About $10,000 will be expended. H. M. Lancaster is head of this property.

The Boston-Montana Silver and Copper Company, Butte, Mont., contemplates the erection of a large concentrating plant in the Rogue River Valley, Ore. Adoph Meier is interested in this company.

The Nevada Leasing and Ore Purchasing Company, Rhyolite, Nev., has acquired a small milling plant at Beatty, Nev. The plant will be remodeled, the capacity increased and new machinery installed. J. T. Carmody is head of this company.

BUSINESS ITEMS

The Independent Pneumatic Tool Company has opened a branch office at 1502 Candler building, Atlanta, Ga. J. J. Keefe, manager.

Garwood Electric Company, Garwood, N. J., for which Charles H. Fowler, Jr., of Elizabeth, N. J., has been appointed receiver in chancery, reports that it is not only completing its unfilled orders, but is also taking new business. The assets of the company are largely in excess of its liabilities.

The Gilbert & Barker Manufacturing Company, Springfield, Mass., announces that contract has been let for the erection of its new plant, which is expected to be ready for occupancy early next spring. There will be nine buildings in the group with a total floor space of 80,000 square feet. The buildings are to be of mill design, brick and steel construction, the largest of which will be devoted to the sheet-metal department; the next largest building will be the machine shop.

FORTHCOMING MEETINGS

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Wanted—Medium weight machinery to build. Wm. A. Cather, Pottsville, Penn.

Sachs' standardized tool requisitions; mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery built to order; modern plant; 30 miles from New York. Box 335, AMER. MACHINIST.

Wanted work in light stamped sheet-metal specialties. Bernardin Bottle Cap Company, Evansville, Ind.

Will buy or pay royalty for a good patented machine, tool, or attachment. Box 1372, New Haven, Conn.

Wanted—Screw machine work; send blueprints or samples for quotations. Remington Mfg. Co., Fitchburg, Mass.

Wanted—Second-hand planer, 72 inches by 12 feet; must be in first class condition. Address W. S. Milne, Cleveland, Tenn.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Special machinery designed and built to order; tools, jigs, fixtures, sheet metal tools and stampings. Frank J. Dyett Co., Ilion, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 900 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Expert designing of difficult work; original work or redesigning special machinery and devices; high-class work only. Henry R. Evans, 3 West 29th Street, New York.

Press Wanted—We want a heavy, powerful, back geared, straight side power press; weight 4 to 5 tons; length of stroke about 2 inches; opening in bed small. The H. D. Smith & Co., Plantsville, Conn.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Wanted—Punch and die work, and screw machine work where accuracy is a prime requisite; best facilities in machinery, workmanship and supervision; prices reasonable. E. E. Wadsworth, 234 Congress St., Boston.

Who furnishes cropped sample nails with bored heads, also a machine for automatic transport and consume of same, also similar articles? Offers with catalogs address to "J. S." 7913 Rudolf Mosse, Berlin, S. W., Germany.

Wanted—To rent or sell, new brick building, equipped with new machinery for manufacturing gas boilers, range boilers or iron barrels; will sell or rent on easy terms or will sell machinery separate. Write Lock Box 36, Big Run, Penn.

Designing Wanted—A man having fifteen years' experience designing special machines,

would like any machine or mechanical device to develop; if you have a difficult problem I can help you out; reasonable charges. Box 455, AMERICAN MACHINIST.

Technical patents are best taken care of by an engineering patent attorney, with sound practical experience, both as an engineer and as an attorney; highest references. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Die and press tools from the simplest to most intricate designed and constructed by experts; will make dies to produce parts and articles of sheet metal at minimum cost; will manufacture parts from the tools if this is desired. Address Die and Press Department, The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

Machinery Wanted—We want to buy large number of second hand machine tools, such as lathes, shapers, planers, millers, boring mills, drills, radial drills, turret machinery, etc., suitable for making motors; an entire plant equipment preferred, but will consider individual tools. "Manufacturer," Box 449, AMERICAN MACHINIST.

A thorough practical machinist and toolmaker, strictly uptodate, expert on automatic and interchangeable machines and tools; German descent, age 31; over 14 years in business, six years in United States; would like to represent, demonstrate or install machines or tools, or assist in installing plant in Russia for some progressive American concern; speaks English, German, Russian and all Slavic languages. Box 446, AMER. MACH.

A company owning a modern and thoroughly equipped foundry, with capacity of 25 to 30 tons per day, with machine and pattern shops in connection, desire to connect themselves with parties having machinery to build, or who may have a patented article already on the market, or who may require medium or heavy castings; have had years of experience in gray iron castings and machine work, and can furnish highest references from present customers. Address Box 453, AM. MACH.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

High-class shop foreman wanted, with experience in most uptodate manufacturing methods in medium-sized machines; we are looking for a man not more than 40 years old, energetic, ambitious and knows how to handle men; a man with experience in manufacturing small engines, small refrigerating machines, or cream separators, preferred; lasting position for the right man. Send application, with references and salary expected to "K. T.," AMERICAN MACHINIST.

INDIANA

Wanted—Superintendent for an established machinery manufacturing firm, well located in the Middle West; its buildings cover twenty acres of floor space, and include machine shops, foundries, pattern shop, forge shop, woodworking department, power houses, labratory, etc.; its line includes light, medium and heavy machinery of high grade only, requiring close and accurate work. A superintendent is desired who has previously handled a similar proposition successfully; he must be particularly qualified to handle the foundries which have a large output of gray-iron castings covering a wide range of different characteristics and weights; also, to produce full output of machine shops, operating at same time on large quantities of small and light parts, and smaller lots of medium and heavy castings and forgings; he must be a good manager of men, capable of producing satisfactory results in production, quality and costs and qualified on special jigs, tools and fixtures. The position will be under the general direction of the works manager, and over a well organized corps of departmental heads; only a man of sufficient experience and actually qualified for this position need apply. Applications will be held in strictest confidence. Box 445, AMERICAN MACHINIST.

MICHIGAN

Wanted—A foreman for a light manufacturing plant to take charge of punch press and screw machine room; state age, references and wages desired. "G. R.," AM. MA.

MISSOURI

Wanted—Superintendent who can invest $2000 to $3000; five-year contract. Suite 616 Commerce Bldg., Kansas City, Mo.

NEW JERSEY

Chief draftsman wanted by prominent marine gasolene engine factory. Box 456, AM. M.

Wanted—Designing engineer, first class man on general machinery; give full particulars. Box 448, AMERICAN MACHINIST.

Wanted—First-class draftsman, experienced on pumping and hydraulic machinery; state age, education and salary expected. Box 447, AMERICAN MACHINIST.

NEW YORK

Wanted—First class designing engineer on adding machine work; to receive attention, state age, experience and salary expected. Box 432, AMERICAN MACHINIST.

Wanted—Active salesman for ball-bearing concern; good opportunity with growing business; state experience, age, and salary expected. Box 454, AMERICAN MACHINIST.

Wanted—By large manufacturing concern in Pennsylvania, horizontal boring mill, to be paid for in exchange for foundry, machine or boiler-shop work. Box 434, AM. MA.

Wanted—Tool steel salesmen for all States to sell a leading brand of high-speed and carbon steels; write, giving particulars, age, salary expected, experience, territory covered, to Box 259, AMERICAN MACHINIST.

Tool designers, experts on punches and dies; only top notchers capable of earning big money need apply; a first-class proposition for the right kind of man; work in New York City. Write, stating age, nationality, experience and salary expected. Box 441, AM. MA.

Draftsmen—Thoroughly familiar with machine shop practice on small interchangeable parts of electrical apparatus; position only for first-class men capable of earning the top market price; no others need apply. Write, stating age, nationality, experience and salary expected. Box 442, AMERICAN MACHINIST.

Wanted—Speed boss in large automobile factory; one who is competent to set premium and speed work prices on sheet metal work, wood work, and gas engine parts; do not apply unless you have held similar position and can make good. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

OHIO

Wanted—First-class machinists on floor and vise work; no labor troubles; steady employment. Box 387, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 399, AMERICAN MACHINIST.

Wanted—Superintendent for sheet metal ware factory, employing 150 hands, located in Middle West; one who is thoroughly competent to take charge of drawing, stamping and spinning sheet metal goods and who can design and lay out the necessary dies, chucks, templates, etc., for this work. Apply, giving age, experience, salary expected and references to "S," AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

UTAH

Wanted—A toolmaker, thoroughly experienced on dies and milling tools for small and interchangeable work; must be a good manager, willing to start at the bottom in our plant, producing especially delicate and finely adjusted instruments, proving efficiency to manage the manufacturing end of the business; a middle aged, married man, with some technical education preferred; the right man may secure an interest in the business; in writing state fully past experience and give references; also instrument makers wanted. G. P. Keller Mfg. Co., Board of Trade Bldg., Salt Lake City, Utah.

WISCONSIN

Wanted—Draftsman familiar with designing centrifugal pumps and other hydraulic machinery; location, Middle West. Box 419, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Superintendent or general foreman; good organizer and uptodate in factory efficiency; United States or Canada. Box 365, AMERICAN MACHINIST.

ILLINOIS

Tool draftsman and designer, 28, wants position; has shop experience and has held executive position in tool room; at present employed. Address Box 452, AMER. MACHINIST.

NEW JERSEY

Experienced shop foreman, practical all-around man, wants position; age 31; expert tool designer; now in charge piece work shop; high-class work; speaks German fluently; excellent references. "Hustler," AM. MACH.

NEW YORK

Superintendent would consider a change. Box 362, AMERICAN MACHINIST.

General foreman, or foreman position in automobile or any machine factory; thoroughly competent. Box 458, AMER. MACHINIST.

Wanted—Superintendency by uptodate mechanic, executive and producer in automobile or regular machine works. Box 459, AM. M.

Tool designer, 31 years, six years' shop, eight years' drafting experience; specialty, fine accurate tool layouts. Box 451, AM. MA.

Superintendent, 20 years' practical and uptodate experience, exceptional mechanical ability, thoroughly familiar with modern cost reducing systems. Box 440, AM. MACH.

Mechanical engineer, expert mechanic, 15 years' experience in designing and operating large machine shop, foundry and erection, desires responsible position. Box 433, AM. MA.

Draftsman, 32 years, desires more responsible position; six years' shop experience; seven years tool designer; experienced on screw machine and press work. Box 450, AMERICAN MACHINIST.

Superintendent, tactful, diplomatic and aggressive, can take initiative in production and development of the business, hustle out the work, reduce costs, raise billing and show results; machinery, structural steel, foundry, tools and dies or manufacturing staple lines. "Mechanical Engineer," AMER. MACHINIST.

Cost accountant and factory bookkeeper, experienced in the machinery line, understanding fully the various distribution of accounts and capable of installing entire factory system, desires permanent position; no objection to going out of town; salary moderate; references. Box 444, AMERICAN MACHINIST.

Mechanical engineer, technical graduate, having five years' experience in shops and engineering department of large industrial plant; experienced on maintenance, shop and power plant construction, and design of special equipment; can handle men; will accept position in any location; employed at present. Box 457, AMERICAN MACHINIST.

OHIO

Designer, experienced in dies, tools and automatic machinery, wants position. Box 220, AMERICAN MACHINIST.

Shop superintendent-engineer, exceptional mechanical and executive talent. Box 425, AMERICAN MACHINIST.

PENNSYLVANIA

Man, several years in charge of general machinery and furnace design, desires situation as chief draftsman or designer. Box 436, AMERICAN MACHINIST.

Works superintendent, in charge of drafting patterns, foundry and machine shop, wishes change; good organizer and cost reducer. Box 429, AMERICAN MACHINIST.

General foreman, age 28, will be open for position about November 1; eleven years' shop and drawing room experience; competent draftsman and experienced tool designer; desire position as assistant superintendent or some similar position with opportunity for advancement; location immaterial. Box 443, AMERICAN MACHINIST.

FOR SALE

One 8-spindle, 20-inch circle, 1-inch drill capacity, and one 14-spindle, 30-inch circle, 1-inch drill capacity, Baush multiple drills; both in good condition and can be seen in operation. For price and further information address the Pratt & Cady Company, Hartford, Conn.

Valuable manufacturing property, about 200 miles from New York City, consisting of machine shop, foundry, pattern shop, smith shop, power house, pattern storage, sheds, etc., suitable for manufacturing pumps, compressors, engines, tools or other machinery; equipment modern and in A-1 condition; railroad sidings into buildings; ten-ton traveling cranes; good shipping point, three railroad systems; fine labor and material market; an established business on a line of high grade machinery could go with plant, if desired, the manufacture of which would utilize a part of its capacity or might consolidate with other business or contract to manufacture other machinery. Box 294, AMER. MACH.

Talks With Our Readers

By The Sales Manager

Sept. 18, 1911.

AMERICAN MACHINIST,
New York City.

Gentlemen:

We have been told by many contributors to the AMERICAN MACHINIST how to take care of the reading matter of the paper so as to get its utmost benefit, but I fail to remember having seen an article devoted to the usefulness of the advertising section, when properly cared for. I hope that this will start an exchange of views on this subject, from which shall spring the best manner to make use of the ads.

It is practically impossible to keep the whole bulk of the AMERICAN MACHINIST and, anyway, it is useless to keep everything. Therefore, I separate every week the reading matter from the advertisements; the former to be kept in its entirety in numerical order, using the publisher's index as table of contents; and the latter part is gone over carefully.

All new ads are cut out, preferably on full page or half-page size if possible and filed in heavy paper envelops, marked with the name of concerns publishing advertisements.

These envelops are alphabetically arranged in a plain box with cover, as the publishers are kind enough to furnish with every issue of the paper a classified index of advertisements which covers practically everything in the machine-making line, and which is more complete than any card index we may endeavor to compile. I paste the several sheets forming the index on tough paper and have in a short time a complete reference. Every four months I throw out the old index and obtain a new one from the last large issue of the AMERICAN MACHINIST.

When I desire information on a certain machine, a glance at the index gives the names of the different makers. If I want to see what a certain concern manufactures, I only have to refer to the envelop.

But this file would not produce best results alone. The manufacturers cannot explain everything in even a page space. The catalogs are the next thing to get and study. These also must be filed, so as to be easy of access, and here again the publishers give us the alphabetical index to advertisers all ready for use. I cut it along vertical lines and paste the columns on stiff white paper, in such a manner as to leave a margin for numbers. These numbers correspond respectively to the shelves and cases of the catalog book-case, where the catalogs are filed by sizes. This alphabetical index, in connection with the classified index, allows any information to be found in the shortest time.

The classification of ads by firms' names allows a quick check of envelop contents for keeping up to date.

I pull out all ads older than a year and file them in binding cases by classes of machines or tools, and it is quite interesting to look over the progress made in some lines while others seem stationary.

To tell now of all the benefits I received from the ads would be too long a story, and I'll only touch a few points. Some ads, such as those of National-Acme Manufacturing Company, Cleveland Automatic Machine Company, running in series, form very valuable booklets when it comes to estimating time for screw-machine operations. Others present new tool equipment and methods of holding work. Still others give, generously, section views of their machines, giving hints as to latest practice in machine design.

The best result of a system for keeping the ads is that it obliges one to look up carefully everything which is published on machine tools and, by doing so, get the utmost benefits from the manufacturers' efforts to make their products known.

P. P. FENAUX,
Lynn, Mass. Designer.

* * *

Only reliable products can be continuously advertised.

Cutting Up the Wreck of the Maine

By Fred H. Colvin*

The way in which oxyacetylene is being used to cut up the torn and twisted wreckage of the battleship sunk over thirteen years ago in Havana harbor.

A few illustrations of the oxyacetylene plant, the work that is being done with it and the problems yet to be solved.

*Managing editor.

It would be difficult to imagine a more striking example of the utility of the gas-torch process for the cutting up of structural steel than that given by the wreck of the battleship "Maine," now lying in Havana harbor. With the method of using cofferdams of steel-sheet piling around the wreck and pumping out the water inside, it became necessary to cut away much of the tangled wreckage in order to remove it and to get at the lower parts of the vessel. And here oxyacetylene has been used to especially good advantage.

Whether it has been used in cutting openings or doorways through comparatively thin plate as *A A A*, in Fig. 1, in order to get at other parts, or to cut off the central tube *A*, shown sticking up through the conning tower, Fig. 2, which has a wall 5 inches thick, it has proved very rapid and effective. One use

FIG. 1. DOORWAY CUT IN COMPARTMENT

FIG. 2. THE CENTER TUBE IN CONNING TOWER

FIG. 3. END OF BOAT CRANE OVER EXPLODED MAGAZNE CUT OFF IN EIGHTEEN MINUTES

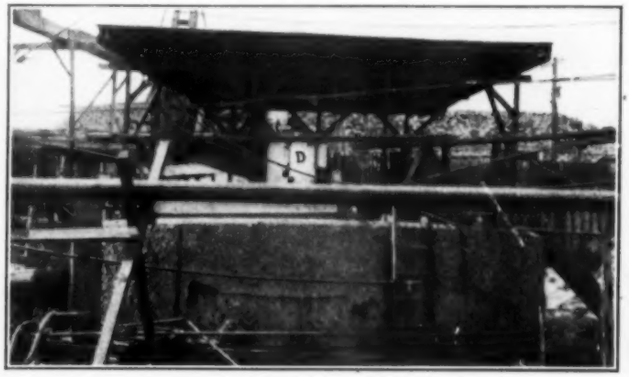


FIG. 4. ACETYLENE GENERATOR ON TOP OF AFTER TURRET

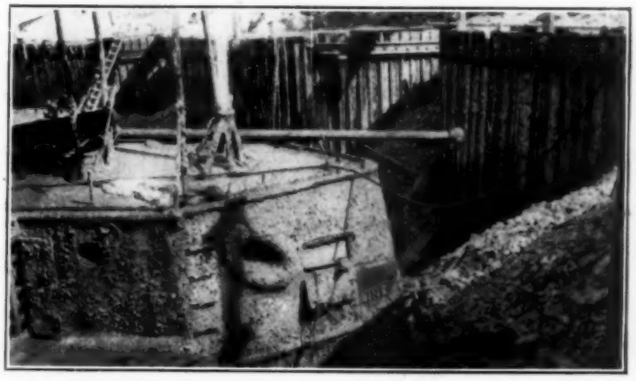


FIG. 5. THE STERN, SHOWING NAME PLATE AND COFFERDAM

FIG. 6. MIDSHIP DECKS CUT AWAY BY TORCH

that came to notice during my stay on board was to cut a hole in a corner of a piece of deck plate, so that the crane hook could get hold of it, this being quicker than attempting to fasten chains around it in the usual way.

Still another example is the end of a cut made in a boat crane on the forward end, near the magazines. This is shown in Fig. 3. The end shown is the portion cut off and the cut is reported to have been made in 19 minutes, while the time given for the conning-tower tube was 38 minutes.

Fig. 4 shows the installation of the acetylene generator at *D*, on top of the after turret on the port side, probably the only oxyacetylene plant ever installed in such a position.

Fig. 5 shows part of the stern, which it is hoped to float by means of the intermediate cofferdam being built across the vessel behind the magazines. The forward section, where the magazines were located, will have to be cut out piecemeal after the remaining mud is dug out.

Fig. 6 shows some of the midship decks cut away by the torch. The oxyacetylene plant and apparatus was installed by the Linde Air Products Company, Buffalo, N. Y., the oxygen being supplied in steel bottles in the usual way. The men on the wreck speak very highly of the work done by the company's representative, Mr. Fritz, in getting the outfit in operation.

I am particularly indebted to Admiral Copps, Colonel Patrick and Major Ferguson for the assistance rendered in securing the photographs and information concerning this important work.

Operations in a Northwestern Shop

By F. A. Stanley *

Special machines used for boring engine cylinders, valve seats and guides.

Jigs for traction-engine cylinders, and an indexing device for drilling radial holes in large traction-wheel hubs.

Method of testing gas-engine cams with a graduated fixture.

One of the largest machine-building concerns in the Northwest is the Minneapolis Steel and Machinery Company, of Minneapolis, Minn. This company builds Corliss engines, gas engines, gas tractors, mining and special machinery, and also has extensive structural-steel and bridge departments.

In addition to its standard-machine equipment the firm has a number of special tools that it has built for various purposes and two of these are illustrated in the halftones, Figs. 1 to 3 inclusive.

Special Boring Machines

Two views of a special machine for boring Corliss cylinders, valve seats, and grinders are represented in Figs. 1 and 2. This machine has a heavy base upon which are mounted supports for the main boring bar, and housings for a pair of bearings in which a crosswise bar is operated. The work is held in suitable rests at each end and the main boring bar is driven by worm gearing at the rear of the uprights, the worm shaft being rotated by a cone pulley belted from overhead. The bar carries cutter heads which are actuated by star feed and is further adapted to carry facing heads for finishing the ends of the work.

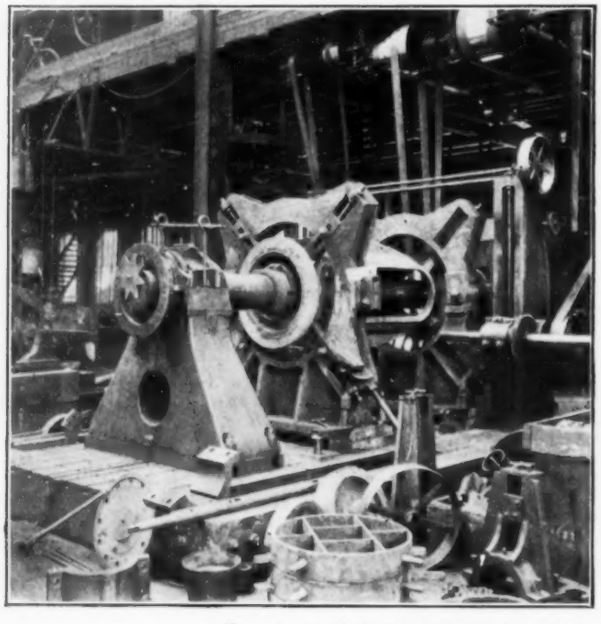
The casting seen in place is a guide section and the auxiliary boring bar on the upright is not required. This is used for boring the valve seats in Corliss cylinders and is driven by a plain belt pulley and spur gearing as seen at the right in Fig. 1. The feed for this transverse bar is applied from the left side of the machine, Fig. 2, where the star-feed device is mounted as indicated.

The bar and its bearings are adjusted vertically by elevating screws similarly to the cross rail of a planer.

The machine in Fig. 3 is an old planer converted into a boring machine for work somewhat smaller than that handled on the tool in Figs. 1 and 2.

The drive for the platen is dispensed with and a boring bar carried by brackets on the stationary table is arranged to feed the cutter head through the work. The machine is shown without the cylinder in place, and the cutter head, cylinder supports and boring-bar drive are seen clearly.

*Western editor.



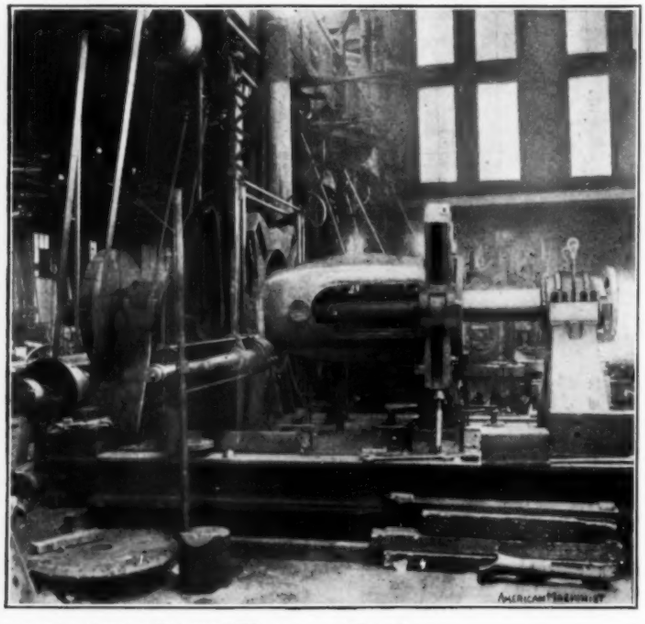


Fig. 1 A Homemade Boring Machine for Large Engine Work Fig. 2

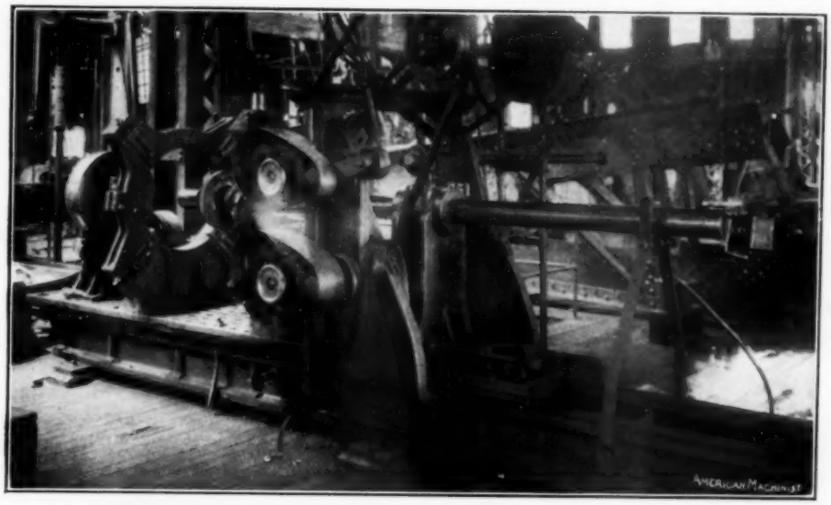


FIG. 3. A PLANER CONVERTED INTO A SPECIAL BORING MACHINE

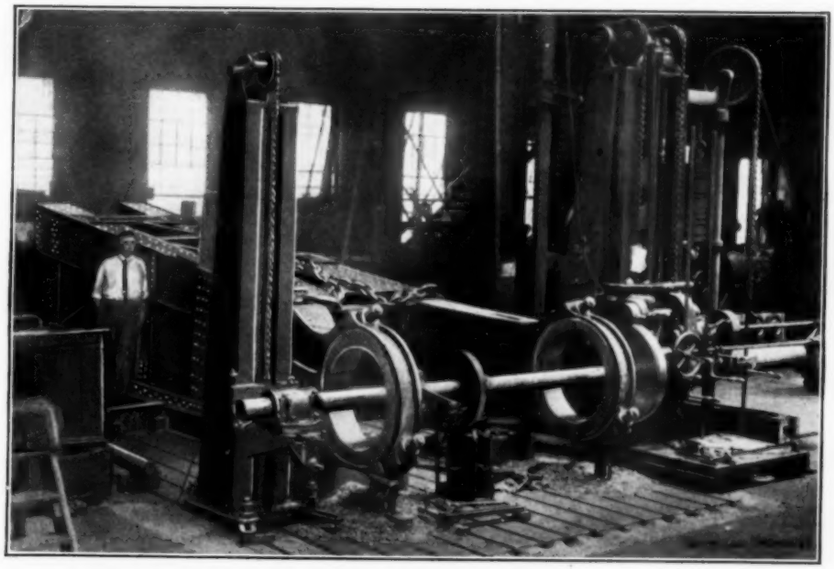


FIG. 4. BORING OUT THE BEARINGS OF A DIGGER LADDER

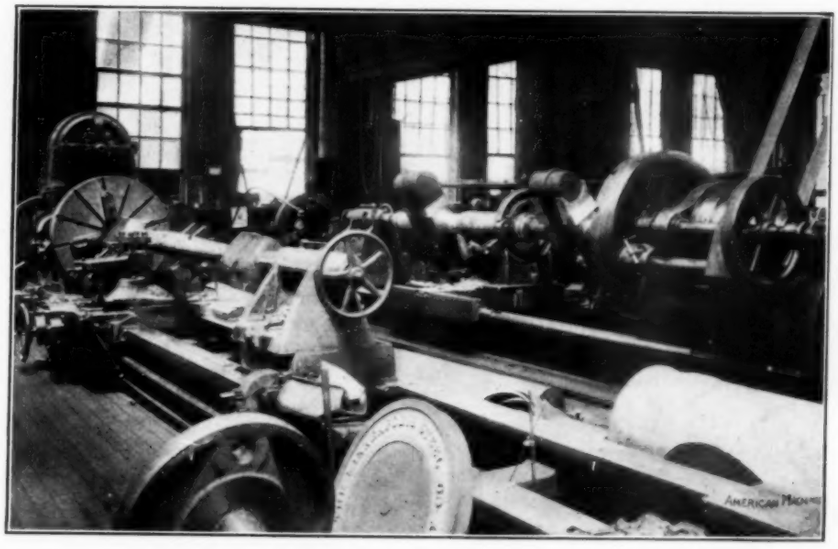


FIG. 5. TURNING CONNECTING RODS AND CRANK SHAFTS

The main boring bar is rotated by worm gearing driven by a series of small round belts passing over the grooved pulley at the right of the worm-wheel case. There are two cross-boring bars which may be set as required for boring two valve openings at once crosswise of the cylinder. The boring bars themselves are drawn back at the far side of the machine, but the two supporting and driving heads are plainly shown upon the housing in front. Both of these auxiliary boring bars are driven from belt pulleys through spur-gear trains as represented, and a star feed is used on all three bars.

A SPECIAL BORING JOB

At the rear of the machine in Fig. 3 will be noticed the projecting ends of a built-up steel structure which is known as a ladder and used in mining regions for digging and lifting sand. The supporting end of this affair is formed of a pair of steel castings to which the steel legs are riveted, and a pair of large bearings for the supporting trunnions is bored out in the structure, as shown in Fig. 4.

The bearings are capped and of course the caps are planed and fitted in place before the boring operation is undertaken. A Niles horizontal machine is illustrated in operation on the work, the boring bar being provided with a cutter head and also with a facing arm, the tool in which is actuated by star feed.

The bearing is bored to about 26 inches diameter. The ladder has a total length of 74 feet, and is in three sections which have to be riveted together end to end. The section shown is about 25 feet in length.

TURNING CRANK SHAFTS AND CONNECTING RODS

Fig. 5 is a view at one end of the main shop, where there are a number of heavy lathes for turning big connecting rods and crank shafts. This engraving shows the method of counterbalancing a double-throw crank shaft, by means of two large pieces of round stock strapped into seats in wood blocks which rest against the rear ends of the crank webs.

A CYLINDER JIG

The jig in Fig. 6 is used in drilling cylinders for a gas-traction engine. This machine has a four-cylinder engine with cylinders cast separately, and the flange holes, the holes at the side and at the opposite end of the cylinders are drilled by means of the simple jig shown. This jig consists of a box into which the work is slipped and then secured by a plate that closes the upper end of the jig.

It will be noticed that there is a steel strap across the top of the jig plate. This is backed at the ends and extends under the side walls of the jig to se-

cure the ends. A headless screw through the strap presses the cover plate tight against the jig and two similar screws through the cover plate bear upon the end of the cylinder and hold the flanged end against its seat.

An Indexing Jig

The jig in Fig. 7 is for drilling spoke holes in the flanges of hubs for traction-engine wheels. The holes are drilled at an angle to the axis of the hub and the arbor upon which the hub is mounted for the drilling operation is at a corresponding angle with the jig base.

The hub is indexed by crank handle and pin which engages a series of holes in the upright face of the jig.

After one flange has been drilled the work is reversed on the arbor and a dog at the outer end is connected with the drilled flange by means of a pointed screw which enters one of the flange holes. The dog is so located on the arbor in relation to the index crank that the holes in the second flange come halfway between those in the first flange, thus securing the necessary staggered position for the two series of spokes.

Cam-testing Fixture

The fixture represented in Fig. 8 is for testing the accuracy of cams for producer-gas engines. The cam shown in place in the fixture is an outlet cam measuring about 6 inches across the circular portion. It also has a starting lobe opposite the exhaust lobe. Both lobes are of steel, hardened, and rigidly secured to a circular hub.

The horizontal plunger at the right has a head corresponding in radius to the regular cam roll and is free to slide on a stud extending through the bracket on the vertical part. There are two pins with one edge on the center line of the plunger and a scale is placed along the edges of these pins while the cam is rotated on its spindle to bring its center line coincident with the edge of the scale. At the same time the finger under the cam is set at zero on the graduated rim of the circular table, and the cam and index pointer are then locked together. This gives the starting point for the test.

The layout of the cam shows the inspector how many degrees the point of opening and closing on the cam should be from the center line, and as he rotates the cam and index pointer he observes if contact is made with the plunger head (representing the cam roll) at the required point as registered by the graduation under the index pointer; also if the cam lobe ceases to control the plunger after the designated angular-cam movement has taken place. If so, the cam is correct and is passed by the inspector and sent to the store room.

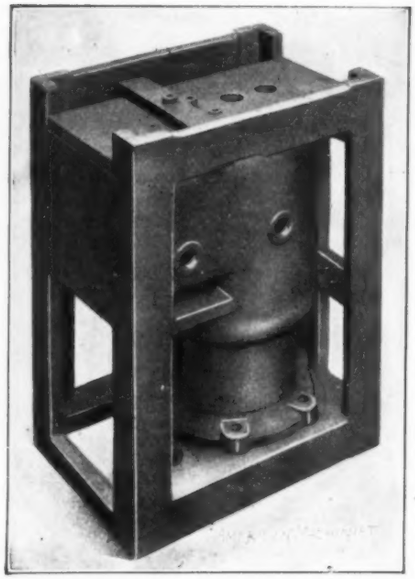


Fig. 6. Jig for Drilling Traction-engine Cylinders

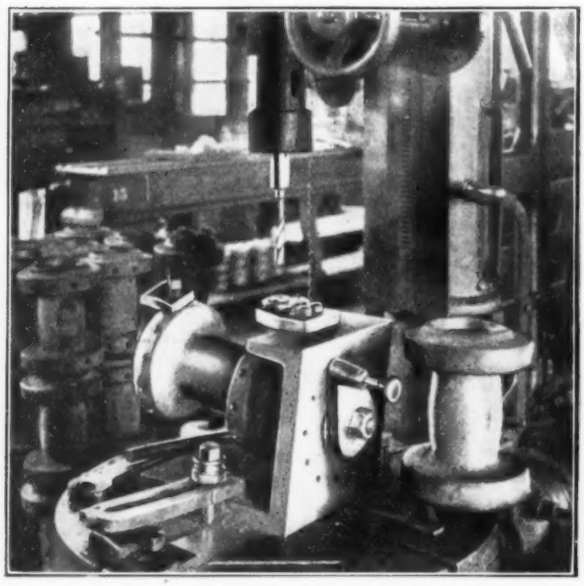


Fig. 7. An Indexing Jig for Tractor-wheel Hubs

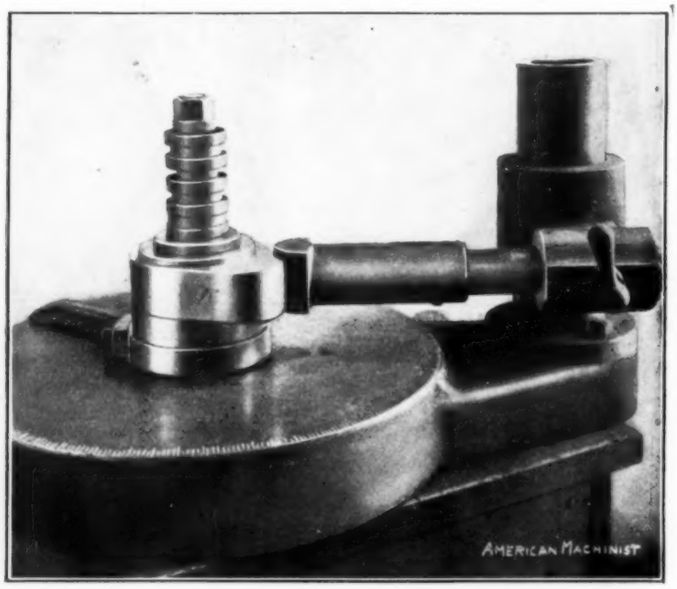


Fig. 8. Fixture for Testing Gas-engine Cams

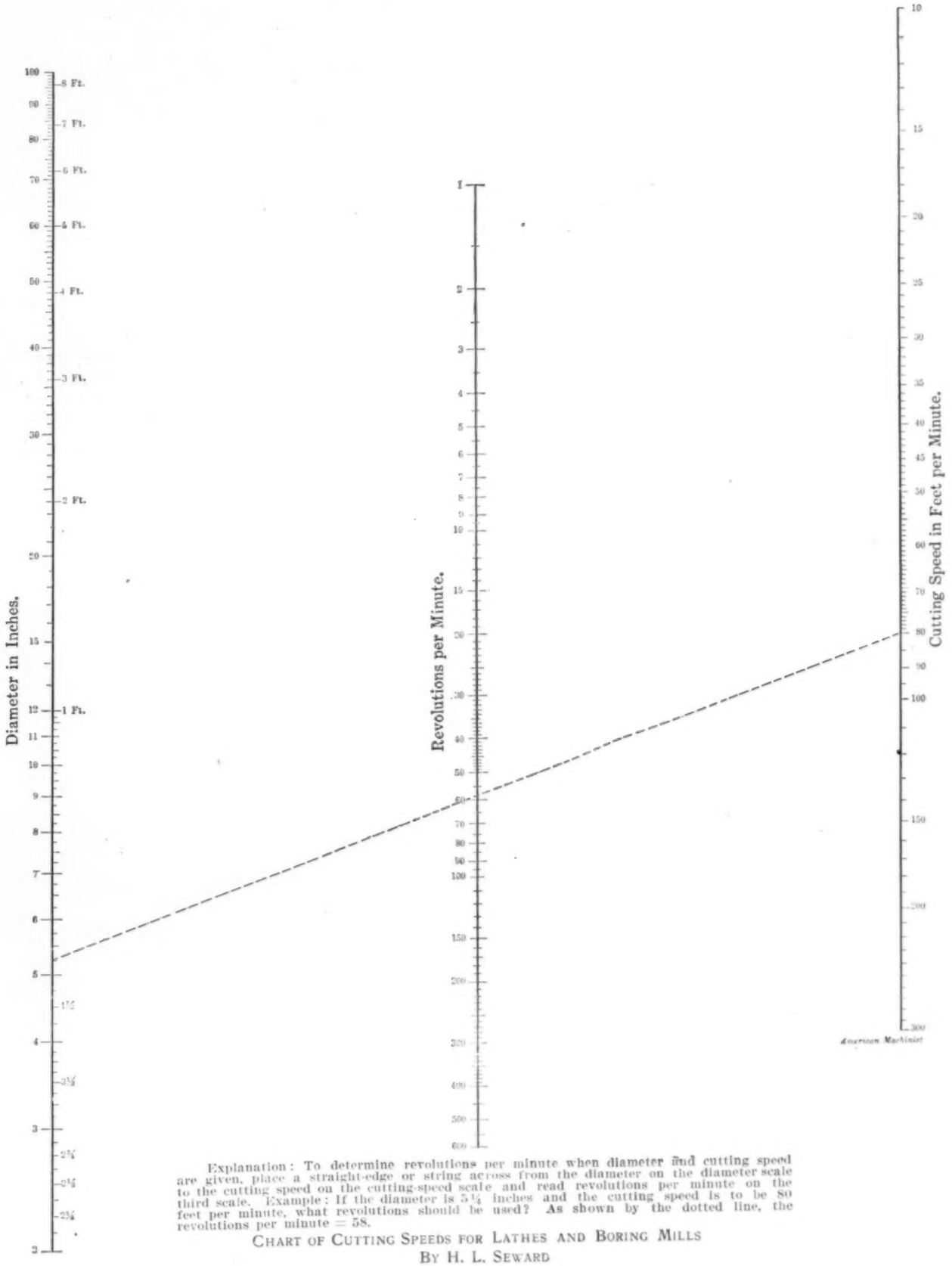
Chart of Cutting Speeds for Lathes and Boring Mills

By Hebrert L. Seward*

This chart furnishes an easy method of obtaining the number of revolutions per minute to use for a given cutting speed on work of a given diameter. To use the chart it is only necessary to lay a straight-edge across the three scales and read the values found at the edge of the straight-edge. For example: If the diameter of the work is 5¼ inches and the cutting speed is to be 80 feet per minute, what should be the revolutions per minute? Lay the straight-edge (or stretch a thread) from 5¼ on the scale of diameters to 80 on the scale of cutting speeds. Since the straight-edge crosses the scale of revolutions scale at 58, the work should run at 58 revolutions per minute.

The chart may also be used to obtain the speed when diameter and revolutions are given, or diameter when speed and revolutions are given. Simply lay the straight-edge across two of the scales at the two known quantities and read where it crosses the third scale.

*Instructor in mechanical engineering, Sheffield Scientific School.



Explanation: To determine revolutions per minute when diameter and cutting speed are given, place a straight-edge or string across from the diameter on the diameter scale to the cutting speed on the cutting-speed scale and read revolutions per minute on the third scale. Example: If the diameter is 5¼ inches and the cutting speed is to be 80 feet per minute, what revolutions should be used? As shown by the dotted line, the revolutions per minute = 58.

CHART OF CUTTING SPEEDS FOR LATHES AND BORING MILLS

BY H. L. SEWARD

Elliptical Gears with Central Bore

By Geo. T. Fonda*

The method of laying out the curves of true rolling contact and curves for the special fixture used in cutting.

*Mechanical engineer, Bethlehem Steel Company.

It is a known fact that two elliptical gears (that is, gears which have true elliptical curves for their pitch lines) will not run together when the bore is at the center of the gears. The first step then is to determine accurately the true pitch lines of the gears, or better, the curve of pure rolling contact.

Construction of True Pitch Lines

This construction is shown in Fig. 1 and was laid out double the size of the gears required to be cut; the reason is obviously for ease of construction.

The first step is to construct accurately the true elliptical curves of the two gears. This is done by taking P as the center of one gear and P' the center of the other. Since our construction is double size $PT = 5\frac{15}{32}$ inches (one-half the major axis) and $P'T = 3\frac{19}{32}$ inches (one-half the minor axis). This makes $PT + TP'$ or $PP' = 8\frac{1}{4}$ inches ($2 \times 4\frac{3}{8}$ inches). Next we circumscribe two concentric circles about P and P' as centers (shown in dot-and-dash lines) where the diameter of the large circle is equal to the major axis of the given ellipse and the diameter of the small circle is equal to the minor axis of the given ellipse. To construct the ellipse, draw radial lines as $P'M$, where M is the intersection of the radial line with the circle whose diameter is the major axis of the ellipse; $P'M$ cuts the small circle at N. Now draw NO parallel to the major axis of the ellipse and MO parallel to the minor axis; then O, the intersection of these lines, is a point on the elliptical curve required. In this way the elliptical curves can be plotted very accurately as shown by the light, inner, full lines in Fig. 1.

Now let us consider the gear whose center is P to be the driver; then the gear whose center is at P' will be the follower. The driver, of course, is turning at a uniform rate and thus its angular velocity must be constant. Since this is true, let us draw radial lines from P as PA, PB, PC, PD, etc., where $AB = BC = CD = DE$ and so on. These radial lines cut the curve of the ellipse at the points 15, 14, 13, 12, 11 to 1 as shown in the figure. As the driver turns about P, the points 1, 2, 3, 4, 5, 6 to 16, will pass the straight line PTP' in succession. From Fig. 1 it is clear that the true contact of the two gears will vary from T to T_1, on the straight line PTP'. Thus to find where the contact would be, when the radial line $P7$ coincides with the straight line PTP', we simply revolve point 7 about P as a center until it cuts the straight line PTP' at 7′ (that is $P7 = P7'$). This point 7′ would be the required contact point if two ellipses, as shown, would roll perfectly together, but as we know they will not we must in some way find the correct point of contact.

Now let us consider what would happen if, as the driver turned about its center P, the follower would roll in perfect contact about its center P'. Supposing this to be true we must now determine what points in the elliptical curve of the follower will be in contact with the points 1, 2, 3, 4, 5, 6 to 16 of the elliptical curve of the driver as these points pass the line of contact PTP'. To do this take the small dividers and set them at $\frac{1}{16}$ inch. Then step off the distance from 0 to 1 on the elliptical curve of the driver, making careful note of the exact number of steps. Now come back to zero (0) again and step off exactly the same number of steps on the elliptical curve of the follower and thus locate point 1 on this curve. This simply means that if the part of the elliptical curve, 0 to 1, of the driver was rolled out into a straight line and the same thing done with the part of the elliptical curve, 0 to 1, of the follower, then these two straight lines would be ex-

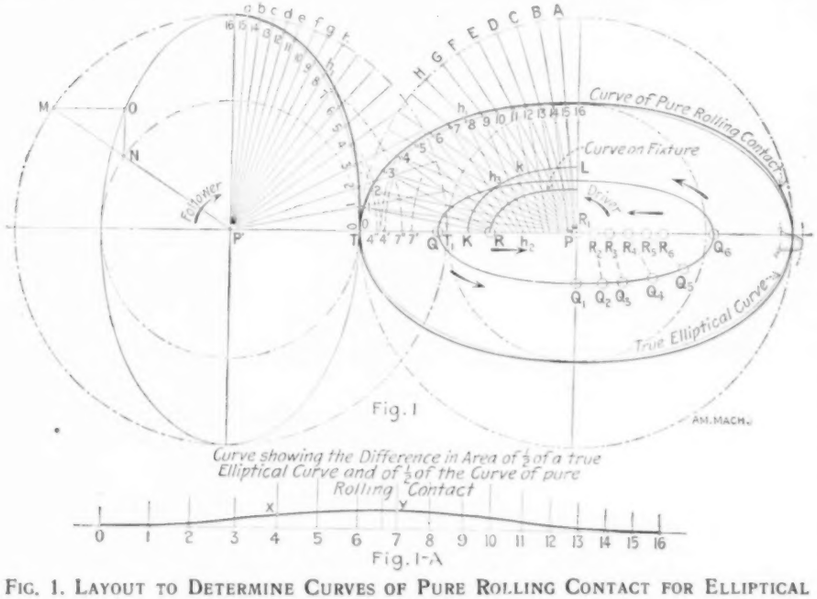

Curve of Pure Rolling Contact
Curve on Fixture
True Elliptical Curve
Follower
Driver
Fig. 1
Curve showing the Difference in Area of ½ of a true Elliptical Curve and of ½ of the Curve of pure Rolling Contact
Fig. 1-A

Fig. 1. Layout to Determine Curves of Pure Rolling Contact for Elliptical Gears with Central Bore

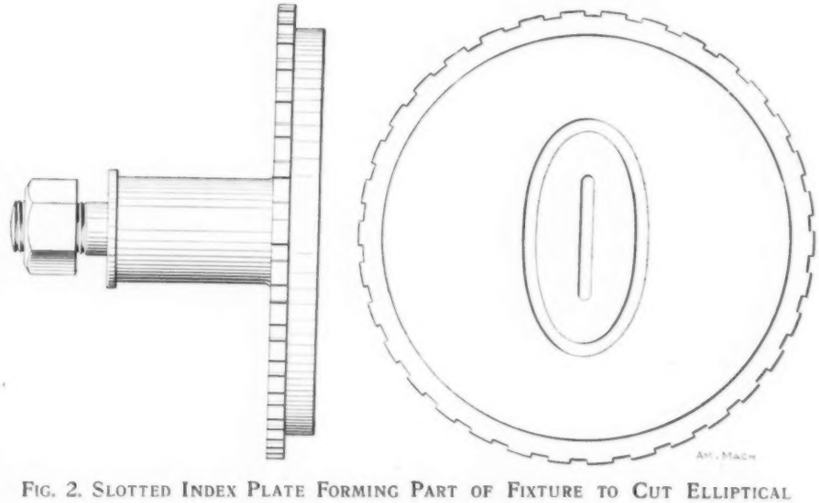


Fig. 2. Slotted Index Plate Forming Part of Fixture to Cut Elliptical Gears with a Central Bore

actly equal in length, which is to say that this distance has been rectified from one curve to the other. In the same manner locate the points 2, 3, 4, 5, 6, 7 to 16 on the elliptical curve of the follower.

It is clearly seen by the nature of this construction that as the driver turns, say until the radial line $P4$ coincides with the straight line PTP', the follower (rolling in contact with the driver as above explained) must turn until its radial line $P'4$ also coincides with the straight line PTP'; thus $P'4''$ and $P4'$ are in a straight line.

Looking now at Fig. 1 we see that when points, 4 and 4 of the two curves are revolved down into the contact line PTP', the points are apart by a distance $4''4'$. This means that the pitch lines of two true elliptical gears of the size shown would separate this distance at such a point 4 of its curvature when this point is on the line of contact PTP' Each point from 0 to 16 must now be revolved down into the contact line PTP' and the separation determined for each point just as explained for the point 4. This construction is shown only for points 4 and 7 so as not to get too many lines in the figure; however, the construction is the same for all other points and this operation should give little trouble.

Plotting the Final Curves

We shall now lay out a curve showing just how the gears separate in turning through 90 degrees. To do this we shall develop the elliptical curve, 0, 1, 2, 3, 4 to 16 of the follower, into a straight line as shown in Fig. 1A. This is done by rectifying the distances 0 to 1, 1 to 2, etc., as before explained, the points being indicated as 0, 1, 2, 3, 4 to 16 on the developed straight line as shown in the figure. Lines are drawn perpendicular to the base line at the points as shown and on these lines we lay up the distance that the pitch lines are apart, which distances we have determined as just explained. For example, ordinate $4x$ in Fig. 1A is equal to the distance $4''4'$ as determined in Fig. 1, and in the same way $7y$ is laid up equal to the distance $7''7'$. So we determine the ordinates of all the points from 0 to 16 and we thus obtain the curve shown in Fig. 1A. Upon an examination of this curve the maximum ordinate was found to be between the points 6 and 7, which means that the pitch line will separate the greatest distance at this point.

From what has been shown thus far by the construction in Fig. 1 it is clear that if one-half the distance $4''4'$ is taken and laid off, one-half on the radial line $P4$ and one-half on radial line $P'4$, then when these radial lines are in the line of contact (PTP'), the pitch lines will be tangent to each other and the distance $4''4'$ will no longer separate them at this point. In the same manner one-half of each ordinate, of the curve shown in Fig. 1A, is laid off on the correct radial lines of the driver and follower. These lines, as will be seen, are distinctly indicated in that corresponding radial lines have been numbered with the same small figures (0, 1, 2, 3, 4, 5, 6, etc.). For example, take the ordinate at the point 8 in Fig. 1A where $8\ h_1$ is just half of this ordinate. We then lay off the distance h_1 on the

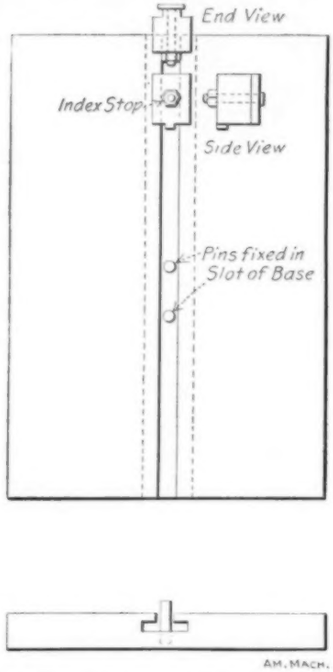


Fig. 3. Base Plate of Fixture Cutting Elliptical Gears with Central Bore

radial line $P8H$ as shown. Again we lay off this same distance from point 8 on the radial line $P'8h$ and so on for every other point. Thus we have now determined ¼ of a curve on both driver and follower which will give perfect contact when the gears are in action.

Having determined one-quarter of the curve the full curve can easily be laid

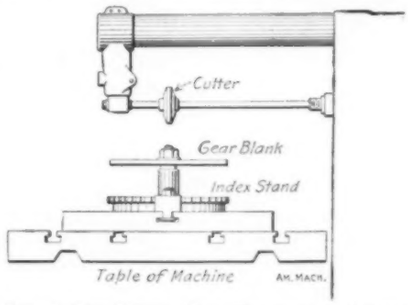


Fig. 4. Set Up to Cut Elliptical Gears with Central Bore

out which is the curve shown in Fig. 1 as the curve of pure rolling contact. Since, by our construction, we have laid off one-half of each ordinate of the curve shown in Fig. 1A, on its corresponding radial lines, on both driver and follower, and since driver and follower are exactly the same size, it is evident that one-half of the area, under the curve of Fig. 1A has been added to one-fourth of the area of the driver and the other half of the area under the curve has been added to one-fourth of the area of the follower. In other words the area under the curve of Fig. 1A shows the difference in area of one-half of a gear whose pitch line is a true ellipse and of one-half of a gear whose pitch line is the correct curve for perfect contact.

Having determined the correct pitch line for perfect contact, we must find some way to cause the cutter of our machine to follow this pitch line and thus cut the correct tooth.

Construction of the Cutting Fixture

Suppose we have a strip of wood that has two pin points fastened in it, which points are $3\frac{9}{32}$ inches apart (one-half the minor axis, remembering that our construction is double size). Draw a straight line on the strip of wood connecting the two pin points and somewhere on this line drill a small hole, into which a sharp pencil lead can be firmly fastened. Place one of the pin points at T, in Fig. 1, and put the other pin point where it will come when in the straight line PTP', which will be at R ($TR = 3\frac{9}{32}$ inches). When this has been done we find our pencil point marks the point Q, between T and R. Now keep the pin point, which is at T, on the curve of pure rolling contact and thus trace the curve while the pin point at R moves along the straight line PRT to accommodate the motion of the pin point starting at T. When this is done it will be found that Q will trace a curve as shown by its path in Fig. 1. Thus, when the point starting at T has traced ¼ of its path, it will be found that the other point has traveled along the straight line from R to R_1, while the pencil point will have traced the curve Q to Q_1. As we continue to trace the curve of pure rolling contact with one pin point, the other point will take up positions R_2, R_3, R_4 R_5, R_6, while Q will take the corresponding positions Q_2, Q_3, Q_4, Q_5, Q_6. We have now reached the half point and it is evident from the figure that in tracing the other half of the contact curve, R will move from R_6 back to its starting point at R, while Q_6 will trace a curve back to Q. The path of the pencil point from Q_6 back to Q will, of course, be the same as its path from Q to Q_6 as traced in the first half of its path, being symmetrical about Q_6PQ.

We can easily find points in the path of Q, as will now be explained. Let us take the point h_1, which is any point on our contact curve. Then take the dividers, setting them carefully at the distance TR (one-half the minor axis), and with h_1 as a center find the point h_2 on the straight line PTP', where $h_1h_2 = TR$. Now set the dividers at the distance TQ and on the line h_1h_2, take $h_1h_3 = TQ$; then h_3 is a point in the path of Q. Any

number of points can be located in this way and an accurate curve plotted.

From the nature of the construction it will be seen that the path of Q will always be parallel to the curve of pure rolling contact, and as has been said, Q may be at any point between T and R, or even outside of T if so desired. There is an advantage in not having points R and Q too close together, which will be explained a little later.

We must now reduce our results to half size, since our scale has been double size. To do this take the radial line $P\,H$ and on it lay off $P\,k = k\,h_1$; then k will be a point on the curve of pure rolling contact, which curve will be the true size of the one required in this particular case. All other points can be found in the same manner and the curve $K\,k\,L$ determined. The curve to be laid off on the fixture will be one parallel to $K\,k\,L$, as shown in Fig. 1. The length of the straight slot in this case will be determined from the point K, just as the straight slot $R\,R_1\,R_6$ was determined from point T. Having thus shown how the results of our construction can be reduced to full size, we will confine our discussion to the double-size construction shown in Fig. 1.

We now lay off on a piece of metal the curved path of the point Q and the straight path of point R, of course keeping their relative positions. Considering these paths as center lines, cut ⅛ inch of metal away on each side, making the cuts about ½ inch deep. Thus we will have cut two slots ¼ inch wide by ½ inch deep, which must be worked out carefully, so that a ¼-inch plug gage will slide perfectly throughout the entire lengths of both slots. It will be seen from Fig. 1 that the straight slot must be cut so that the gage can slide the full distance R to R_6, measuring from the center of the gage; this is very important.

Next, let us take two steel pins which have been carefully ground to ¼-inch diameter, and fasten them firmly into a smooth steel plate, being very careful to keep their centers apart a distance equal to the distance $Q\,R$. The pins should not project above the surface of the plate more than ⅜ inch. When this has been done, place the plate into which the slots have been cut, upon the plate containing the two pins and carefully fit the pins into the slots. It will now be found that as the upper plate is rotated the pins will slide in the slots and will thus cause this plate to move in the manner required for our fixture.

In Fig. 2 is shown the plan and elevation of the fixture required to cut the given gears. On page 82, of Mr. Grant's "Treatise on Gears," will be found a layout of what he calls a "trammel stand." The stand shown in Fig. 2 is on the same order, with the exception that it is made to fasten the gear blank at the center and not at the focus; also the difference in the slots found on the under side of the stand is an important change. An index wheel is cut on the stand, as shown, and there will be just as many notches in its circumference as there are teeth to be cut (in this case 34). The diameter of the index wheel is not limited, for if we lay out a tooth, as shown in Fig. 1, and determine its center line, we can then determine the center line of the next tooth. These center lines can be produced until they cut any circumference and the intersections on the circumference will give the distance between notches, from which our index wheel is determined.

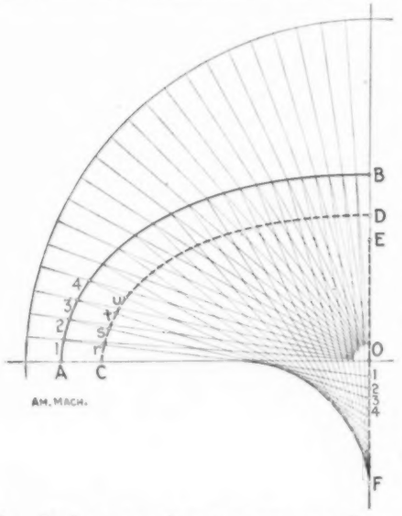


FIG. 5. ANOTHER LAYOUT FOR THE CONTROLLING CURVE AND SLOT

SET UP FOR CUTTING

Fig. 3 shows the plate upon which the index stand rotates. The pins are fixed in the slot of the plate, the slot being required so that the index stop can slide to accommodate the motion of the index stand (this is also explained by Mr. Grant). In cutting the first tooth the stand should be turned until the pins are in the positions Q and R, shown in Fig. 1. Then the gear blank will have its center at P and its major axis will extend along the line $P\,T\,P'$. The pitch line of the cutter will then be lined up directly over the point T. The index stand should be turned to the first notch and the first cut taken. From this point on the notches will take care of the cuts.

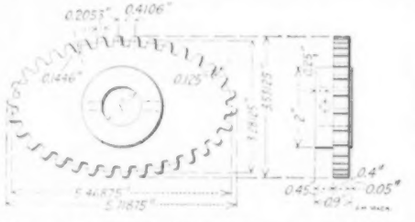


FIG. 6. FINISHED DRAWING OF THE GEARS

Fig. 4 shows the positions of the parts when the machine has been set up and is ready to cut the blank.

It is not wise to have the pins, shown in Fig. 3, too near together. The reason is that the pins will get a better hold on the index stand when they are not too near together, and thus a more positive motion of the stand will result. If the distance between the pins is changed, then the curved slot, as shown in Fig. 2, would have to be changed likewise, but this new slot, as has been explained, would be exactly parallel to the first one. The straight slot will not change in length, as can be seen from its construction, but will remain constant for any given size of gear.

There is one other point that should be brought up in this discussion; this is shown in Fig. 5. It is quite possible that when pins R and Q (Fig. 1) pass from R_1 to R_2 and from Q_1 to Q_2, respectively, absolute positive motion will not result. This might be caused by poor workmanship in cutting out the slots, or it might be caused by wear. At these points the curved slot and the straight slot approach parallelism, which makes such a condition possible. However, this error can be avoided, as will be explained.

In Fig. 5 we will take a point at O and one at A. The curve $A\,B$ has been taken from Fig. 1, and is the curve of pure rolling contact. Now suppose again that we have the strip of wood with pin points at A and O and a pencil point at C. Point A will trace the curve $A\,B$, while point O will move in a straight line to F, which will cause the pencil point to trace the curve $C\,D$. The curve $C\,D$ will, of course, be parallel to curve $A\,B$ and thus may be taken anywhere, however, not letting it intersect the straight line $E\,O\,F$ ($O\,E = O\,F$). We now have the center lines for two new slots ($C\,D$ is one-fourth of the full curve), which when cut out of the index stand, will give the correct motion to the gear blank and any condition of parallelism will be avoided.

Fig. 6 has *not* the curve of *pure rolling contact* as its *pitch line*, for the drawing room did not take the trouble to construct this, since it would not save the shop any work.

As has been explained, all curves had to be laid out on metal in the shop, and, therefore, it would only be extra work for the drawing room to go over the same work.

It is reported that the French government has decided to establish in the United States a permanent mission for the study of industrial, technical, and commercial methods. Leclerc de Pulligny, chief engineer of the bridges and roads of France, has been named by the Ministry of Public Works as the head of the mission, which was to have left on September 1 to take up a residence in New York City.

Shop Lighting Installation*

By C. E. Clewell†

Certain features that bear on the utility of lighting installation work.

Some points that illustrate work of this kind based on actual locations.

†Lighting expert, Westinghouse Electric and Manufacturing Company, East Pittsburg, Penn.

Scientific Plans

In order to insure satisfactory results when lighting the new shop, or when revising that of the old, the plans should be in the hands of one who is not only competent to predetermine the results from previous experience, and who possesses a knowledge of the principles of illumination, but who likewise appreciates the value of good light in its relation to the economy of the shop and to all concerned therewith.

Adequate light should be considered as an aid to production and to the general welfare both of employee and employer. The well lighted shop is the one most likely to have a larger product of higher quality than the one in partial darkness on cloudy days and at night; there is usually a better disposition abroad and the accidents and mistakes will likely be less.

Consideration should be given to the fact that excellence in the lighting of a shop can be gained at an expense equal to 1 or 2 per cent. of the total cost of productive labor, whereas the absence of good lighting may cost as much as 10 to 20 per cent. of the product due to less or defective work. The attention of the designer should, therefore, be directed to the superiority of results rather than to undue reduction of first cost.

The scientific plans will include such features as the intensity and uniformity of the light, the elimination of glare, the type and size of lamp best suited to given locations, the mounting and spacing of the lamps, and an economical switching arrangement.‡

The Working Drawing

An aid to accurate installation work is the embodiment of these scientific plans in a clear and practical working drawing, the object of which is threefold: First, to enable the wiremen to install the lamps according to the plans; second, as a guide to the lamp department in the materials required; and third, as a guide to the designing engineer in checking up the work and also when future plans are required for similar locations. These objects are realized if the drawing contains an outline of the ceiling space to be equipped, a designation of the lamps and their spacing, the specification of material, i.e., lamps, reflectors, holders and type of switches, the mounting hight of the lamps, and the method of switch control. Figs. 1 and 2 indicate two typical shop-lighting drawings.

In order that the plans may be followed intelligently, the drawing must be based on accurate measurements of the ceiling space in question, and be comprehensible to the average wireman. It is discouraging to the man who lays out the lamp locations on the ceiling to find that the dimensions are incorrectly given. The tendency in such cases is for the wireman to take the necessary modifications into his own hands, which is likely to affect the excellence of the lighting result.

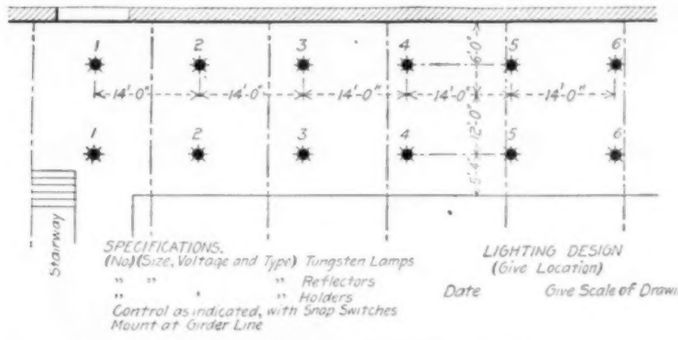


FIG. 1. TYPICAL WORKING DRAWING, SHOWING ONE SIZE OF LAMPS

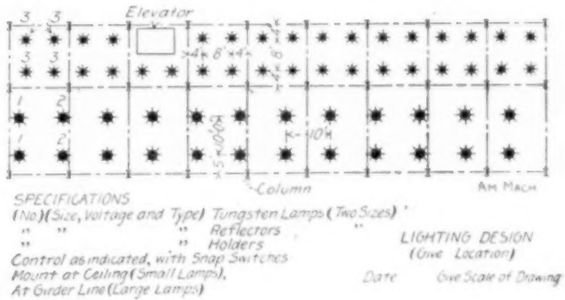


FIG. 2. TYPICAL WORKING DRAWING, SHOWING TWO SIZES OF LAMPS

The Estimate

An estimate of the work should follow the plans. To this end a blueprint of the working drawing will be helpful, since the wiring arrangement can be indicated on the print in pencil.

The materials required will depend somewhat on the manner in which the wiring circuits are laid out and also on the architectural details of the shop. If the location is relatively inaccessible, due either to the hight of the ceiling or to a crowded condition of the floor space, the labor cost will naturally be high. In rewiring an old shop, if the floor space is crowded with workmen, or if the work must be done from the crane on account of the inability to use ladders, the installation will usually be made outside of regular working hours so that the work or the crane service is not delayed.

TYPICAL SHOP LIGHTING ESTIMATE

Labor and material to install 52 tungsten lamps

1500	feet wire (give size and style),
700	feet molding (give type),
260	feet conduit (give size and style),
13	one-half inch bends,
26	one-half inch bushings,
26	lock nuts,
26	snap switches (give style),
13	fuse blocks (give style),
26	fuse casings (give style),
52	kilowatt cut outs,
52	keyless sockets,
52	wood bushings,
2	rolls tape,
4	pounds solder,
2	gross wood screws,
2	boxes brads,
100	feet standard blocking,
150	security knobs,
150	flat head screws,
200	feet sash chain,
300	feet flexible lamp cord,
52	tungsten lamps (give size, voltage, and type),
52	reflectors (give size and type),
52	holders (give type),
	Labor,
	Other expense,
	Total,

This column for cost values.

Notes on the work (Date)

FIG. 3. TYPICAL SHOP LIGHTING ESTIMATE

‡For more detailed information on these items see "Shop Lighting Design."

*This is the fifth of a series of articles on shop lighting being written by Mr. Clewell for the AMERICAN MACHINIST. There have already appeared in Volume 34: "Machine Shop Lighting," page 595; "Drafting Room Lighting Problems," page 686; and "Foundry Lighting Problems," page 1076; in Volume 35: "Shop Lighting Design," page 346. Other articles will appear soon.—EDITOR.

The illustrations in this article were all reproduced from unretouched photographs taken at night by the light of the lamps themselves.

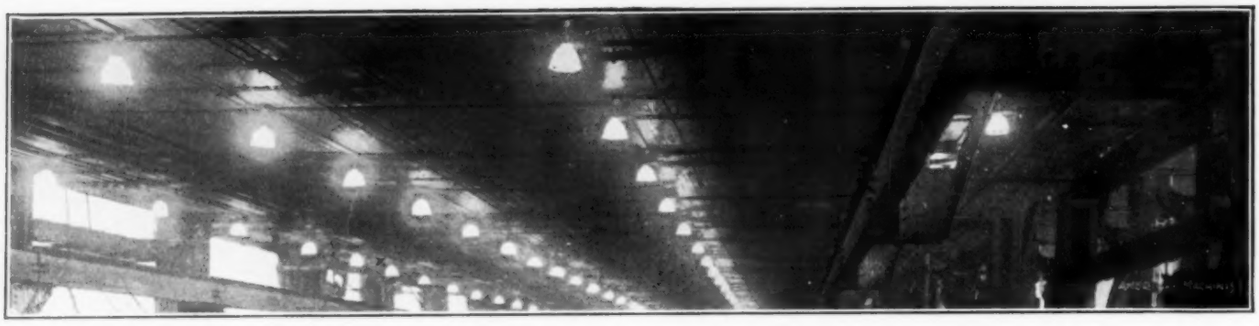


FIG. 4. WOOD CEILING, NO UNDER-BEAMS OR UNDER-JOISTS

Fig. 3 shows an estimate of a typical installation covering a detailed list of material, labor and other charges. A copy of the estimate should be placed in the hands of the wiring department to indicate the wiring material required and also the amount of labor expense that has been included in the appropriation for the work.

power will be required by the new system than by the old, in order to insure what is today considered an adequate amount of light for shop work. Hence old supply mains may be found insufficient in capacity.

Regarding the second question: Some lamps are suited to direct current only, and others to certain frequencies of alternating current. The circuits in various parts of the shop may, therefore, limit the choice of the type of lamp to be used.

Regarding the third question: While it may be an economy in some cases to use the old wiring, the differences between old and new plans are usually so marked, that what may be saved in the utilization of old wiring and accessories may be more than offset by the labor involved in adapting the material of the old system to the new.

One advantage is obvious in making plans for the lighting of an old shop, that of knowing the location of machines, benches and the work, as well as the class of work performed in the space under consideration. While modern lighting methods have as a distinctive feature the providing of light uniformly over the floor space so that work may be done at any point, it is nevertheless an advantage to know the class of work so that the requisite intensity and quality of light may be provided, and also to know the nature of the machinery, belting etc., so that actual needs may be taken care of in the matter of side light, absence of shadows, and the like.

FIG. 5. WOOD CEILING, SMALL UNDER-BEAMS

OLD SHOPS

Several questions will arise as follows:

1. Are the old supply mains adequate for the new system?

2. Is the old electric circuit suited to the new lamps?

3. Can the old wiring be utilized with economy?

Regarding the first question: While new electric lamps are in general more efficient than old, former methods were usually so inefficient in the matter of the quantity of light provided, that often more

NEW SHOPS

While there are some advantages in wiring the old shop as indicated in the foregoing, there are also some points which make it an advantage to plan for lighting a shop before it is put into operation. Some of these are as follows:

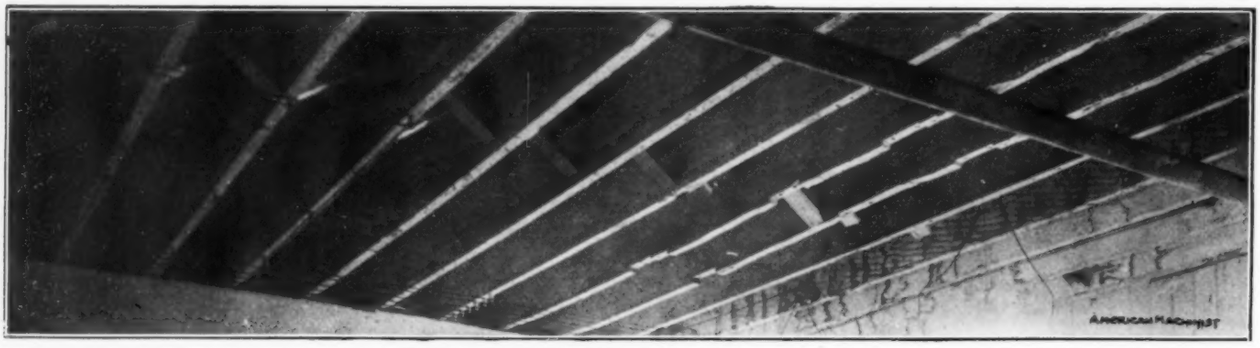


FIG. 6. WOOD CEILING, UNDER-JOISTS CLOSE TOGETHER

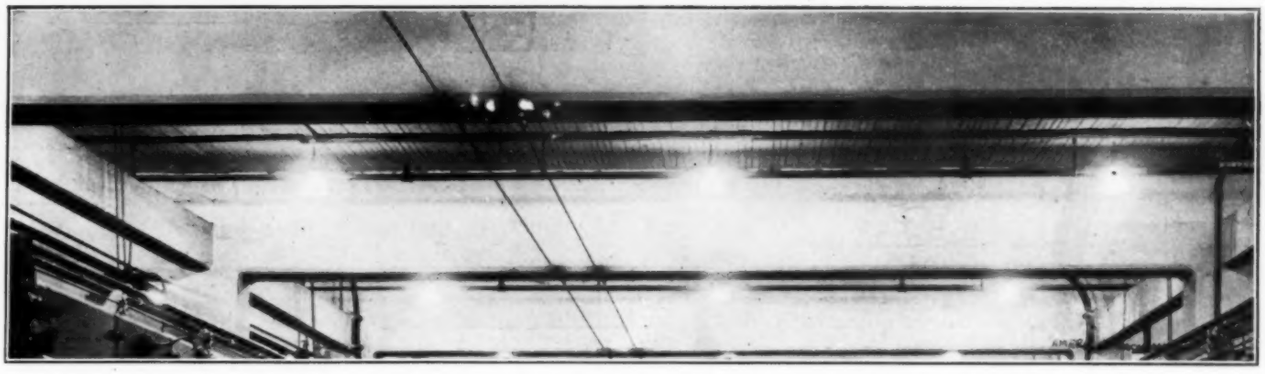


FIG. 7. WOOD CEILING, CEMENT UNDER-BEAMS

1. The plans will not be influenced by old wiring and old intensities of the light.

2. The wiring may be completed before the building is equipped with machinery and in operation, thus usually reducing the first cost.

These advantages are, however, somewhat offset by the fact that it is easier to predetermine lighting results after seeing a plant in operation than when dealing with empty space. A study should be made of the proposed arrangement of machinery, work, belting and shafting, and a visit to a similar shop will be an aid in making the plans. It is advisable to arrange the lamps to take care of readjustments of machinery, and to allow somewhat for blackening of walls and ceiling in the calculation of the quantity of light deemed necessary, since these surrounding conditions play a considerable part in the *average* efficiency.

SOME LOCATIONS FOUND IN PRACTICE

The ceiling construction determines to a large degree the ease or difficulty of installing the wiring. To show the great variety of conditions in shop construction, the following list is given:

1. Wood ceilings, no under beams or under joists.
2. Wood ceilings with under beams or under joists.
3. Open-girder construction; no ceilings.
4. Plaster ceilings.
5. Tile ceilings.
6. Brick ceilings arched; iron girders.

Figs. 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13 show typical shop ceilings.

In the wiring work associated with the foregoing partial list of ceilings, the following are some of the methods which have been found useful: Wood molding, metal molding, iron conduit, open wiring and stringer boards, the last mentioned often being used where open-girder construction exists, molding in turn being run under these boards. Figs. 14, 15, 16, 17, 18 and 19 illustrate some methods of arranging the wiring on various ceilings. Obviously the difficulty and cost increases with the amount of work required to attach the wiring devices to the ceiling.

In the open-girder construction the wires are sometimes run in conduit on

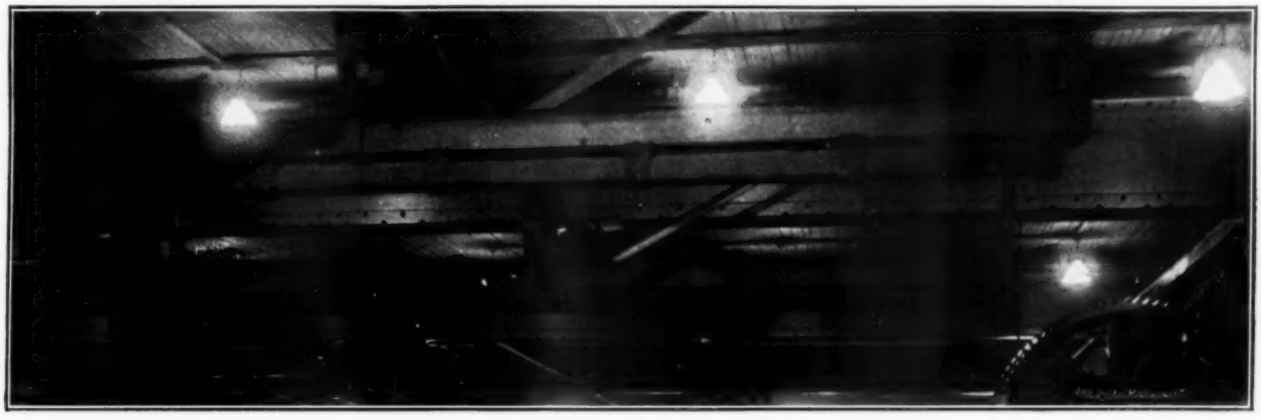


FIG. 8. WOOD CEILING, IRON UNDER-GIRDERS

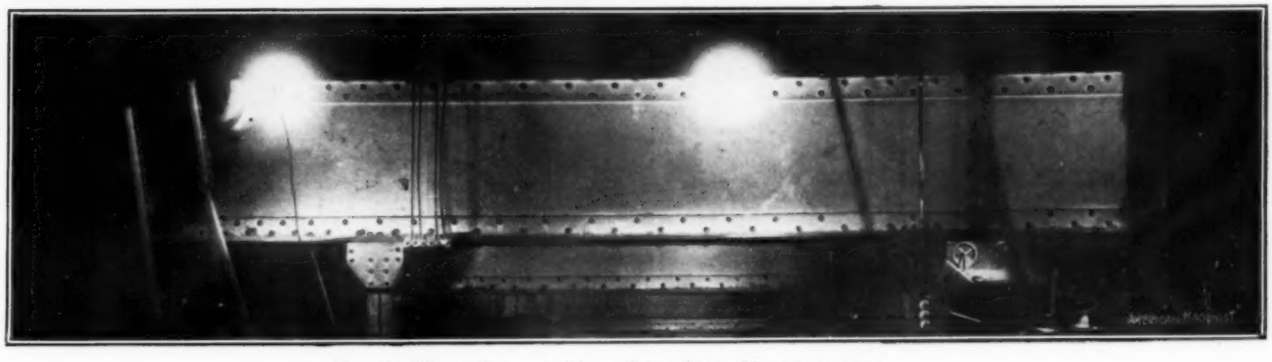


FIG. 9. WOOD CEILING, VERY DEEP IRON UNDER-GIRDERS

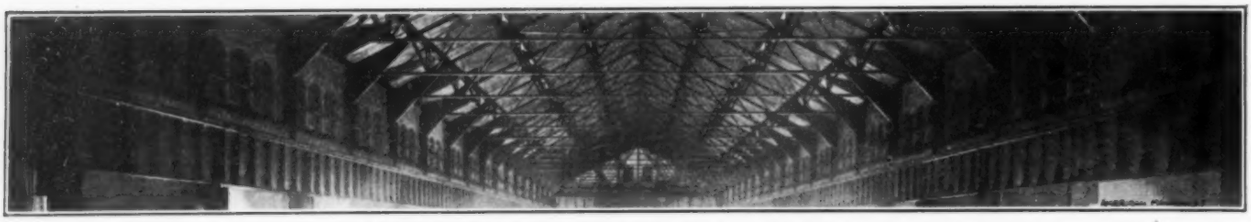


FIG. 10. OPEN-GIRDER CONSTRUCTION, NO CEILING

the under side of the girders, particularly in those cases where the lamps are located on the girders. Where, however, the lamps are located between the girders, a plan often followed when medium-sized units are used, so called stringer boards, consisting of a board reinforced on top with a ribbed strip, are mounted so as to span the bay, and the wiring is placed on the under side of these boards. These boards should be strong enough, where the girder line is sufficiently low, say, 16 feet or under, to permit the use of a ladder in making renewals and repairs. For this reason special precautions will be advisable, as a preventive of accidents to maintenance men, in mounting these boards so as to withstand a considerable strain, and it is evident that in such cases the strength of the boards must be made greater than merely to support the weight of the wiring, lamps and auxiliaries.

Fig. 14 indicates a location with tile ceiling. In cases of this kind, holes must be drilled into the tiling, and toggle bolts may then be inserted for the purpose of supporting the moulding. It also illustrates a rather ornamental method of running the molding on the ceiling in a case where concealed wiring was not feasible. This wiring has been fed from the outlets of an old and inferior lighting system. The use of "pull" switches eliminated the necessity of running switch loops down the walls, thus considerably decreasing the first cost.

Fig. 15 indicates the wiring arrangement on a wood ceiling where concealed wiring was not feasible. This was an office location, and is shown to illustrate the neat manner in which the molding may be run, giving a symmetrical appearance to the ceiling and being rather ornamental than otherwise.

Fig. 16 indicates the wiring arrangement in a shop with wood ceiling. The diagram shows the arrangement of switching, which calls for six switches per bay, a feature considered advisable on account of the location of the work in this particular shop. The switch loops in this case are run down cement columns, the switches being mounted on iron outlet boxes attached to the columns.

Fig. 17 indicates the arrangement of shop wiring on a brick arched ceiling. This wiring scheme is not the most economical so far as the voltage drop is concerned, but was installed for the benefit of a low first cost where the difficulties in the wiring were very great. With wires sufficiently large, however, the voltage drop to the end of a circuit will not be appreciable with small lamps in a case of this kind. Small stringer boards are attached to the ceiling, and the wires are run on the under side of these boards. The switch loops are run down on steel columns.

Fig. 18 indicates the switching arrangement in a certain shop where iron con-

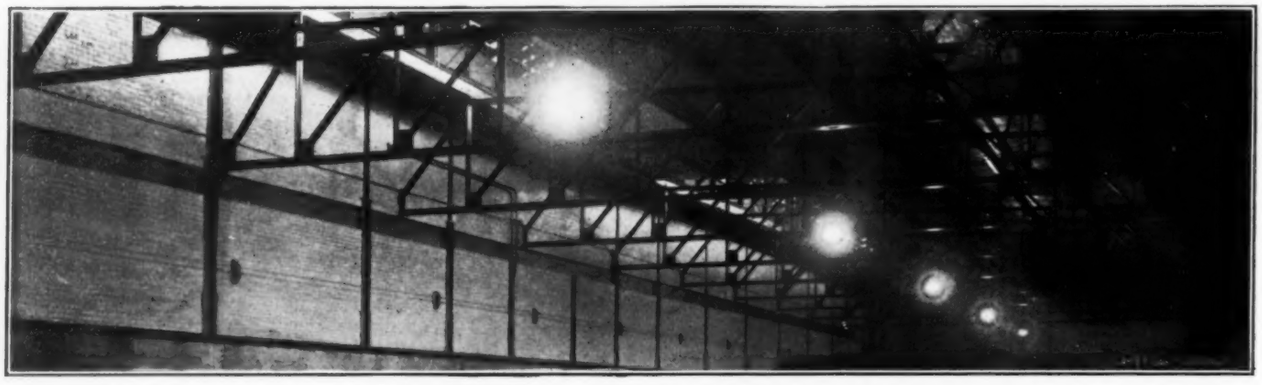


FIG. 11. ANOTHER SCHEME OF OPEN-GIRDER CONSTRUCTION

FIG. 12. OPEN-GIRDER CONSTRUCTION, NO CEILING, STRINGER BOARDS

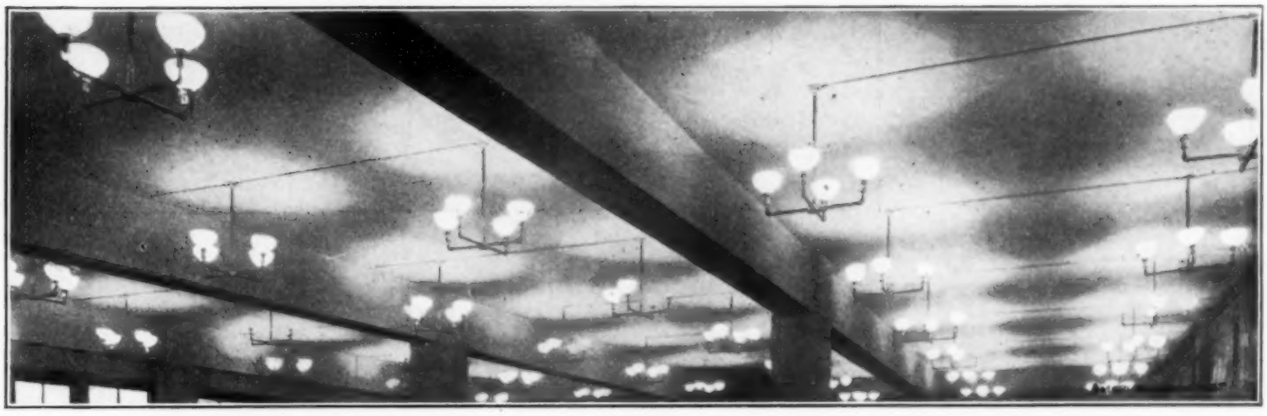
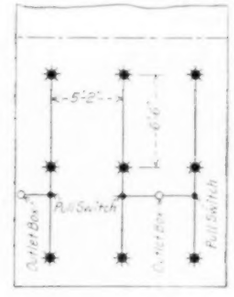


FIG. 13. PLASTER AND TILE CEILING; ORNAMENTAL METHOD OF INSTALLING MOLDING



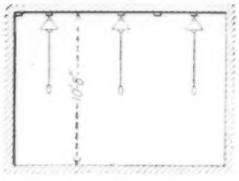


FIG. 14. TYPICAL BAY, PLASTER AND TILE CEILING

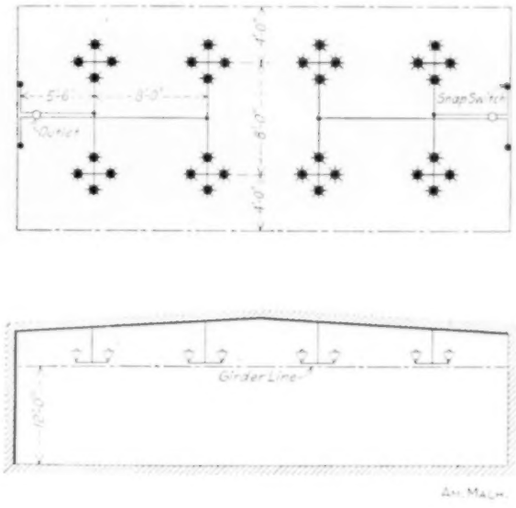


FIG. 15. TYPICAL BAY, WOOD CEILING, WOOD TRUSSES

duit has been used and where a double intensity of light seemed necessary at different portions of the day. One-half or all of the lamps may be turned on in a given row at pleasure. The rows of lamps have been mounted directly below and along the girders which divide each bay and, although open-girder construction exists, no stringer boards have been required.

Fig. 19 is a location similar to that of Fig. 8, with open-girder construction. Owing to the plans which call for mounting the lamps between girders, stringer boards have been provided. These boards span the girders and the wires are run under these, as shown. Here an entirely different manner of switching is used, which is deemed superior to that shown in Fig. 8.

IMPORTANT ITEMS CONNECTED WITH THE INSTALLATION

Underwriters' Rules—Adherence to such rules relating to shop wiring as designated by the Fire Underwriters will be assumed. The wiring should be installed for permanence and so as to insure reliable service. Some of the important items to be observed are as follows:

Accessibility of Lamps for Maintenance—Whereas modern illumination practice calls for mounting the lamps high and out of the range of vision, care must be exercised to mount them so as to be accessible for renewal, cleaning, and repair purposes. Where crane service exists, the lamps may generally be dropped from the ceiling when installed, so as to be reached with ease from the top of the crane. Where, however, there is no crane, the lamps must sometimes be mounted low enough to be reached by a step ladder or equivalent. In case of very high bays it may be desirable to build a walkway below the peak of the roof from which the lamps may be reached. One scheme in such cases is shown in Fig. 20, where the lamps are in two rows, and are pulled in on trolleys to the walkway for trimming, and are allowed to run out into place by gravity. This permits of mounting the lamps so as to furnish an excellent distribution of the light without interfering with the crane service, and also of trimming and repairing from a convenient place. The importance of this scheme will be appreciated when it is considered that these lamps hang 50 feet above the floor.

With ceiling hights of, say, 25 feet, arc lamps may at times be arranged so as to be raised and lowered for trimming. Here, however, care must be taken to safeguard the loops of wire so that they

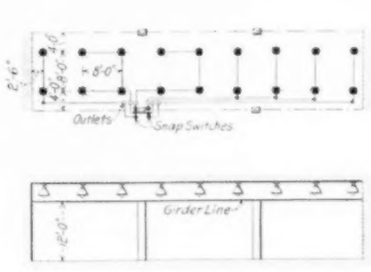


FIG. 16. TYPICAL BAY, WOOD CEILING, DEEP UNDER BEAMS

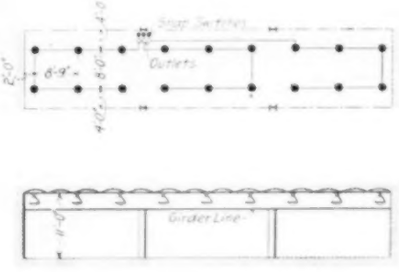


FIG. 17. TYPICAL BAY, BRICK-ARCHED CEILING, IRON GIRDERS

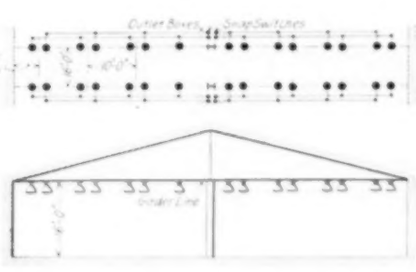
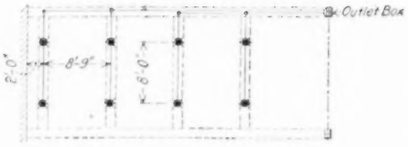
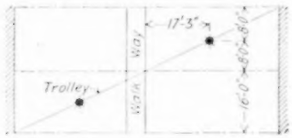
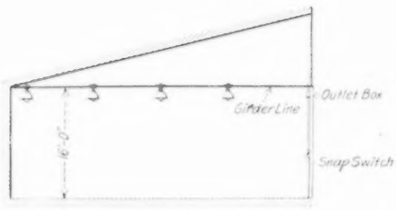


FIG. 18. TYPICAL BAY, OPEN-GIRDER CONSTRUCTION, NO STRINGER BOARDS







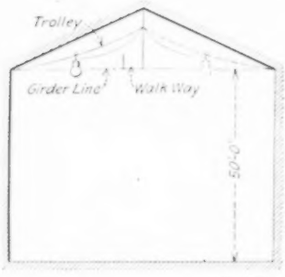


FIG. 19. TYPICAL BAY, OPEN-GIRDER CONSTRUCTION, STRINGER BOARDS

FIG. 20. TYPICAL HIGH BAY, LAMPS ON TROLLEYS, WALKWAY

are not in the way of cranes or other shop operations.

Special Methods of Supporting Lamps—The most advantageous method of supporting the lamps in the average location will be evident to the wiring foreman. Some cases, however, arise from time to time where a special scheme must be provided. This is particularly true where no means of support is feasible on the building construction directly over the point at which the lamp is to hang. In the high shop bay just mentioned, the lamps are arranged in two rows up and down the aisle, 50 feet above the floor as stated. From the walkway directly below the ceiling roof truss anchor wires are run to the sides of the building, and the lamps are run from the walkway out toward the side on these anchor wires used as trolleys, being drawn in when required, and supported on these same wires in the ordinary burning position. This scheme previously referred to, is shown in diagram in Fig. 20.

Another scheme for mounting arc lamps is by means of a simple reinforced bracket, as shown in Fig. 21. This will apply, of course, only to those cases where the lamps cannot conveniently be mounted on the building directly above their location, or where it is desirable to suspend the lamps away from a wall.

Large tungsten lamps should not be supported from lamp cord directly connected to the socket and the rosette. One way has been
chains attached to the reflector holder and anchored to the ceiling. In addition to this safeguard against accidental falling of the lamp and reflector, a wire screen woven on the outside and inside of the reflector is an additional precaution in case the glass reflector is broken by accident. Fig. 22 indicates the method of mounting large tungsten lamps with supporting chains.

Tungsten lamps are being used successfully and on a large scale in shops with no other means of absorbing the shock than by mounting the lamps with chain, and in the case of small lamps with an inch or more of lamp cord between the socket and rosette. In exceptional cases, however, the weight of the lamp and reflector may be placed on a "bird cage" spring device to absorb undue shock.

Dense Belting—Where tungsten lamps are mounted in a location among belting and line shafting, it is necessary in some cases to alter the location of a lamp here and there from the position shown on the drawing, in order to clear obstacles. Furthermore, the lamps must often be lowered to clear the belting and shafting and also reduce the effect of dust and dirt on the reflectors due to their being in the line of flying particles from the belts when too high. Pipe supports have been used in some cases, as shown in Fig. 23, to prevent the lamp cord from becoming entangled with the belt if it leaves the pulley accidentally.

Location of Switches—It will be found desirable, particularly where a large number of medium-sized lamps are used for a given area of floor space, and as a consequence a large number of switches, to mount the switches so that they will be convenient and easily found.

Series circuits should be protected at either end of the line so that the lamp may be completely dead when trimmers or repair men are at work. Where the number of lamps on each of such circuits is small, there will be an undue number of switches for the ordinary control of the lamps, and confusion will result if each circuit can be controlled at two entirely different points of the floor space. Here it will be found advantageous to cover one set of the switches for ordinary purposes, the lamps to be turned on and off at one point, while the other set is accessible to the wiremen only.

Where the switch loops must be run down cement columns, iron conduit with an outlet box has been used. One or more switches may be mounted on a given box and the various loops run in a single piece of conduit. In a similar manner switch loops may be run down iron columns.

Reflector Holders for Tungsten Lamps—Where a large number of glass reflectors must be removed from time to time for cleaning purposes, the ease with which they can be removed is quite a factor in the economy of this part of the maintenance. Two items will insure facility in this operation: First, a holder with mechanical merit, and second, a reflector with a uniform neck which fits the holder snugly without requiring force to insert or remove it. This feature is an important part of the specifications when considering reflectors of different types for industrial service.

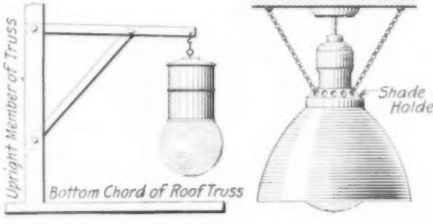


FIG. 21. TYPICAL BRACKET FOR SUPORTING LARGE LAMP

FIG. 22. MOUNTING LARGE TUNGSTENS

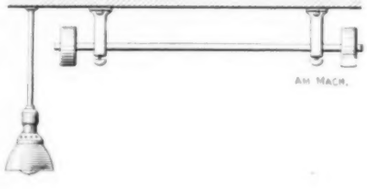


FIG. 23. MOUNTING TUNGSTENS AMONG BELTS

On the Placing of Small Numbers of Lamps at a Time—When revising the lighting in an old shop it is always advisable to consider the new system as a whole, but not its immediate complete installation. A satisfactory method in such cases is to equip a small section of the shop at a time with the new lighting. The entire plans should, however, be drawn up for a given section of the shop before beginning the work, so that everything will properly fit together as new work is added from time to time. Another excellent point in this method is the opportunity afforded to try out a new system on a small scale before equipping an entire section or shop, thus permitting any slight modifications and improvements to be embodied in the final arrangement.

The Work of Installation—After the plans have been drawn up and the work

estimated on and approved, the wiring and lamp departments should receive copies of the drawing and the detailed estimate. The materials should then be ordered, after which the work of installation may proceed. The wiremen should chalk out the location of lamps on the ceiling from the drawing when a ceiling exists, ready for the inspection of the engineer, who should satisfy himself that all the requirements of the design are met. In case stringer boards are required, they should be mounted and their locations inspected by the engineer before any wiring is done.

Summary—From the foregoing notes some idea may be gained of the refinements of modern shop-lighting methods as compared to the older hit-or-miss plan. Coöperation between the engineer and the wiring force is essential, and the endeavor should be made to acquaint the wiremen with the importance of accurate adherence to the plans in every detail.

A shop with a lighting arrangement based on careful plans presents a pleasing appearance, but what is vastly more important, possesses an asset which is invaluable to the highest economy in production and to the general efficiency.

Time Saving Schemes in the Drafting Room

By R. B. Dale

There are a large number of established short cuts that are used in the drafting room. While most of them have been mentioned from time to time in the American Machinist, the writer has taken this occasion to review the more prominent of the schemes in the hope that their renumeration in a single paper and the remarks and suggestions which accompany may be of interest. No claim of originality is made. While there may be many omissions from among the great number of time-saving schemes, care has been taken to avoid mentioning those of questionable utility. Drafting devices, such as the drafting machine, the illuminated board, the vertical board with parallel motion straight-edge, have not been mentioned because their utility is generally recognized. An attempt has been made to describe only devices and schemes which are not primarily intended for the drafting room, but which are efficient time savers if properly used.

The Typewriter a Valuable Accessory

One of the most valuable accessories is a good visible typewriter. In the engineer's office where technical reports and calculations must be recorded in permanent form, a "mathematical" machine which is provided with the mathematical characters, Greek letters and facilities for writing fractions and chemical equations, is of great value. With this machine tabulated data of various kinds, price lists, and the general information which is issued from time to time to the selling agents or prospective purchasers, may be written with great facility. When there is a possibility that more copies may be required than is possible to manifold by the carbon-paper process and, in fact, as a precautionary measure in all cases where the office is likely to be called upon for copies at any time, the sheet which receives the impression from the keys may be "backed up" for blueprinting. Place a carbon sheet with the impression side to the back of the first sheet, or better still, use a double-impression carbon behind the first sheet. If a good quality of thin paper is used and the type work is neatly and carefully done, it should be possible to get a very good blueprint from this original. Excellent blue-line prints or brown-line prints may also be obtained by the Van Dyke process.

When printing a number of small sheets they should be fastened together at the corners with gummed strips so as to form a single sheet of convenient size. If the tabulated data is accompanied by an outline drawing in which letters are inserted for the dimensions and the dimensions for the various nominal sizes given in the table under the column headed with the corresponding letter, the results will be very satisfactory if all of the work, except the lines of the drawing, is done with the typewriter. For this work the Gothic type is thought to be somewhat more effective than the Roman. This method is much more rapid than attempting to do a large amount of descriptive lettering or of tables of figures by hand.

Where the Hektograph Is Helpful

Small simple drawings or descriptive matter may be produced in quantities of 60 or 80 on the hektograph. For this work the writer prefers the old-fashioned sort made of glue and white lead and placed in a shallow pan. If the original inking is done on tracing cloth there will be no tendency for the lines to spread due to the fibers which occur in paper. Care must be taken in inking the original not to smear the ink, as it scarcely dries at all. If a thin strip of wood or metal be placed at each side of the sheet when inking the horizontal lines and at the top and bottom when inking the vertical lines, the work can be done without difficulty. The hektograph inks may be had in various colors and pleasing effects may be obtained by using the different colors judiciously. This method is not suitable for drawings more than 9x12 inches or 9x14 inches in size. This scheme is particularly satisfactory with "form drawings"; that is, drawings not made to scale and with the dimension lines left blank and afterward filled in by sets of three or four with carbon paper. The advantages to be gained by having a number of these blanks on hand to be filled out when needed, thus furnishing rapid individual service to the prospective purchaser, is apparent. The scheme may also be used to advantage for simple shop drawings or diagrams in any case where the general shape of the part does not materially change with changing dimensions, such as, for example, engine crank shafts, crank disks, connecting rods, etc.

Carbon Sketches

Carbon sketches of simple parts may be made in sets of three or four. No especial precautions or instructions are necessary in making these. A hard-lead pencil should be used in making the lines. The lines may be made either free hand or with a straightedge and to scale. A hard paper board, such as the waterproof board used in connection with the letter-copying press, or a piece of smooth sheet iron should be placed beneath the sheets to give a hard, smooth backing. The paper should be thin and tough. A thin bond letter paper is excellent. If only a single copy is needed for the shop or field, the sketch may be made with copying ink, and the office record secured by copying in the letter-press book. In the above mentioned processes, variety is produced and emphasis given by using different colored carbons and inks.

Card Drawings

In drawings which are intended to show suggested arrangements of machinery or apparatus, considerable time may be saved by having on hand a set of cards on which the drawing is made to a suitable scale and which may be shifted about from place to place on the main drawing, as desired. If the machine is made in rights and lefts, the cards should be transparent so that they could be reversed if desired. This scheme is particularly useful in designing power plants or manufacturing plants. If the building plans are placed with an architect, the machinery contractor may cooperate by furnishing the architect these cards with the drawings made to a scale of ¼ inch or ⅛ inch to the foot. If the machinery contractor is furnished the general plans of the building and requested to suggest arrangements, it will be found that these cards will greatly facilitate the work. It is suggested that zinc etchings of the standard machine sizes might be made to scale and the drawings printed on thin sheets of celluloid, if it is found that they can be used in sufficient quantity to justify the expense.

The Camera's Possibilities Not Appreciated

The camera is an accessory to the drafting room that has not received its share of appreciation. Perspective line drawings may be obtained by photographing the apparatus and tracing the principal lines of the photograph. Constant use may be made of it in reducing and

enlarging line drawings. A blueprint may be copied by photography if it is changed to a brown with the ammonia and tannic-acid process. First immerse the print in a dilute solution of aqua ammonia until the coloring is removed, then wash and immerse in a weak solution of tannic acid until the print is of a deep-brown color. Wash and dry, after which it may be photographed without trouble. While the camera has not been recognized to any great extent as an adjunct to the drafting room, it appears that its most effective use lies in reducing large-size drawings to a size more convenient for handling in the shop and field. Small-size drawings are much more convenient to handle than are the large size, but they are much more difficult to make by hand, especially when there is a mass of detail. They may be reduced by photography, the only restriction being that the letters and figures do not appear too small to be easily read.

The Small Hand Printing Press

The small hand printing press is one of the most valuable of all of the drawing-room accessories. Use for it will be found in many ways, from forms for use in the drafting room and about the works to printing notes and titles on tracings. If particularly handsome titles are desired, it is possible to set them up in type and print them on the tracing in much less time than is required to execute them by hand. To prevent the ink from smearing it is only necessary to shake powdered soapstone or chalk over the wet ink. The ink will absorb the chalk and the tracing may then be handled at once.

Other Helps

Many valuable forms and blanks which will expedite the work in the drawing room will suggest themselves. For instance, the chief draftsman will find a blank form to be filled in when assigning work to be very convenient. The blanks may be printed on different colors of paper, say, yellow and white, and made up in a block with the colors alternating. Using a sheet of carbon paper when making the record, the chief draftsman may tear out the white sheet and present it with the papers in connection with the work to be done, while the yellow sheet remains in the pad as a reminder of the assignment. This is thought to be a much better scheme than the use of stubs, as it does away with the trouble of filling out the stubs.

In most drafting rooms the occasion often arises when it is desired to bind and preserve papers in permanent form. Time and expense will be saved, and the work done uniformly and neatly, if a small book-binding outfit and paper trimmer are procured. A willing boy can soon learn to bind books of blueprints, blank forms, pamphlets, reports, etc., very satisfactorily, in addition to his regular work.

While all of the schemes here mentioned would not be suitable for every drafting room, it is hoped that some helpful suggestions have been given to all. Some of the equipment is expensive, yet the result will justify the outlay if a large amount of work is to be handled. Every scheme should be carefully considered which promises advantages in the accuracy, neatness and speed with which the work is done in the modern drafting room.

What Effective Organization Means

By C. J. Morrison*

It means improved physical well being and improved working conditions for everyone employed in a shop where it is in force.

*Manager, department of effective organization, Suffern & Son, New York.

The efforts to increase the productivity of each workman and to decrease the cost of production have caused some uneasiness on the part of the workmen themselves. This apprehension is only natural as in the past efforts at increased production have only added to the burdens of the workmen. One of the fundamental weaknesses of the old system of organization is that everything is put up to the workmen. This is one of the prime evils of piece work. The customary practice has been to set a price, leave it up to the workmen to solve the problem of meeting the price, and, as soon as they found the solution, to cut the price. The management did not assume its share of the burden, and in many cases actually added to the burdens of the employee.

In one memorable case a shop had no facilities for grinding tools and the men were compelled to go a long distance to another shop to grind their tools. The installation of proper abrasive wheels was recommended, but the superintendent objected to putting them in, giving as his reason, "Those men are all on piece work." When pressed further, he stated, "We used to have grinding wheels in there, but I took them out when the men were placed on piece work." He is a fine type of the old school of management, and there are many others like him. Is it any wonder then that the new methods of effective organization are looked upon with apprehension in some quarters? They are in exactly the position of one who having been once stung is ever afterward suspicious.

A fine example of the difference in the old and new methods of organization can be drawn from the conversation of two machinists, recently overheard in a street car.

"Hello Jack! Still at ———?"

"No, I had to leave there several weeks ago."

"Why? I thought that was a fine job."

"It was, but it was ruining my eyesight. I was cutting ——— and the reflection of the light from the headstock of the lathe hurt my eyes. I suggested to the foreman that I paint the headstock black, but he would not listen, so I had to quit. Can't make as much money at ——— but did not want to lose my eyes."

Here a machinist lost a good job and the company a valuable employee because the organization was at fault. The workman's suggestion was put up to a line officer who had no reason to be particularly interested and nothing was done. Under a system of effective organization the suggestion would have gone to a staff officer whose duty it would have been to investigate. The result would have been that either the machinist's suggestion would have been adopted or a better method of doing the work devised. In either case the man would not only have retained his job, but would have been paid for the suggestion.

Lack of Education under Old System

There are many items to be considered in determining what effective organization means to the workman. Probably one of the most important items is that of education. Under the old system of organization no one was interested in the education of an apprentice, or workman either, in or out of the shop. He learned what he could in the shop mostly by hard knocks, and, if he was ambitious, studied at nights when he was not too tired or did not have to work. As my own training as a machinist's apprentice was under the old organization, the difference is very real to me. The only instructions came from my fellow workmen, and were usually very meager, as they had their own work to do and little time for instructing apprentices.

One of the first machines which I ran was a shaper and my instructions were, "Take that shaper over there." A machinist ran the shaper next to the one to which I was assigned, but was indifferent and could give me little help. As both were slow and the work was heavy we worked three nights a week and every Sunday for three months. At the end of that time a very skilful young machinist replaced the other man on the

shaper. He took an interest in me and taught me how the tools should be dressed and ground, what were proper cuts and feeds, how to chuck work, etc. In a very short time the overtime and Sunday work was eliminated as we had caught up and were able to keep pace with the rest of the shop.

My experiences on the various other machines and on bench and erecting work were similar. Sometimes someone would show me a few kinks, but usually I was left to my own devices.

Educational Advantages under Effective Management

Under methods of effective organization this is all changed. When an apprentice is assigned to a machine an instructor goes with him, explains the machine and shows him how to start his first work. Nor does the instruction stop here. On the contrary, the instructor comes around at regular intervals and, as the apprentice improves, instructs him in the refinements of the work. Furthermore, the apprentices are moved from one machine to another, and from one department to another at regular intervals and are always under competent instructors. These instructors are men chosen on account of their combined skill at the trade and their geniality and ability to instruct.

The apprentice's general education is also cared for in a school where they are given good, sound, practical instruction. Those who show particular aptitude in certain branches are given a chance to take more advanced work. In the most modern shops the classes meet in the first morning hours, which are the best hours for instruction, as the mind and body are not yet fatigued. Moreover, the boys are paid for the hours spent in school at their regular rates. Evening classes are also provided where any employee, except an apprentice, may receive instructions free of charge. In one large shop 15 per cent. of the employees, other than apprentices, attended the classes regularly the first year the school was started. Moreover, as an effective organization recognizes overtime as an evil, both to employer and employee, it is eliminated and the men have time to attend classes. Contrast this with the old method of management and think how many capable men are still in the rut on account of the lack of even an elementary education. This work was not undertaken as a philanthropy and it is not my purpose to give that impression. Very complete records have been kept, the expenses and returns, both direct and indirect, recorded, and it has been found that the work pays.

Conditions Affecting Physical Well Being

In addition to providing for an education the physical well-being of the employees is looked after and it is well known that unhealthy bodies and unsanitary conditions make for ineffective work. The workrooms are provided with the best light, heat and ventilation that the most skilful engineers can provide. Contrast this with the old order. I worked for six months on a machine where the light was so poor that a torch, one of the old smoky variety, had to be used even on the brightest days. Furthermore, the machine stood under a 24-inch drive belt which not only covered me with dirt but endangered my life, and I was obliged to stand on a rotten, oil-soaked floor which caused trouble with my feet. There are thousands of places just like it today, but such conditions are not found where the methods of effective organization are in force. In fact, effective organization goes even farther and provides sanitary lockers, individual wash bowls, baths, dining rooms, etc. As far as possible recreations are also provided.

It has been found that a baseball team is a splendid promotor of loyalty to a company. Employees will "root" for the team on the field and for the company wherever they may be.

Realizing that an injured employee is not profitable, every possible safeguard is provided, gears are covered, abrasive wheels are hooded, belts are guarded, dust and gases are conveyed away.

Manufacturing Conditions

Considering the actual manufacturing, all conditions, materials, work and tools will be standardized. Each machine will be kept in condition for maximum production. The work will not come first in one condition then in another, but must pass inspection and be according to the standard. The methods of performing work will be studied, standards established and the employees instructed so that they will work according to these standards. In making these studies every element will be considered and the standards adopted will be the best method from the standpoint of material, time, power required, labor cost, expense burden, quality, and fatigue to the workman. More than this, a new job will be brought to each workman shortly before he finishes the one upon which he is working. With this job will be instructions, blueprints, tools, jigs or whatever may be required to perform the work.

In case the work is heavy, hoists will be provided and help sent when it is required. It will not be necessary for the workman to hunt all over the shop for the various items needed or for him to have to coerce a helper into assisting him. Neither will he find work piled all around him so that he must "paw over it" every time he wants something. The idea is that the productive workman shall have nothing to do but produce, and produce under the most favorable conditions. This does not in any way whatever reduce the man to a machine. In fact, as he is relieved of all petty annoyances he is in far better condition to think than under the old system and to think in a constructive rather than in a destructive sense.

Under an effective organization an employee will be paid for every valuable suggestion. Moreover, he will not be paid any petty one or five dollars, but according to the value of the suggestion. In a recent case a man was paid $50 for a suggestion that was never used, because the suggestion opened the eyes of the mechanical engineer of the company to a defect in the machine.

Objection is often raised that under the new method of management a workman will be kept on one class of work year after year, and thus worn out by the monotony. Whether or not a man can work for a great length of time upon one particular job depends upon the personality of the individual and upon the conditions under which the work is done. Some men are so constituted that they can do the same thing day after day for years without being seriously affected, while others could not stand the monotony. However, anyone would be able to work longer without being affected under the conditions of effective organization than under the old order. However, to wear a man out on one job is contrary to the theories of effective organiation. Not only is a record kept of each employee, but he is carefully watched and as soon as the record or the man shows evidence of going stale, a change in work is made.

This record of each employee is important in another way, as it releases the workmen from the tyranny of the foremen. There are probably no worse tyrants anywhere than some of the petty foremen. When each employee stands upon his record and is not dependent upon the personal likes and dislikes of some petty official, he attains true independence. Not only does each one stand upon his record, but the records are closely watched and any fluctuations investigated in order that the true cause may be ascertained. In one concern employing 1200 men, the president looks over the individual records of each man every week. Any fluctuations must be explained to him and it is absolutely impossible for a foreman to discharge or persecute a valuable man. There are three grades of employees in this establishment, and a man is automatically promoted from one grade to another, according to his record. An instance of the value of these records recently came to notice. Two years after leaving a concern to accept a better position, a man applied for a situation as general foreman, and gave as reference the company for which he had formerly worked. An inquiry was made and the reply given: "He is a 108 per cent. man." He got the job and made good.

Results of Effective Organization

The results of the work of effective organization is to increase the output per employee, to decrease the unit cost and thus to increase the profits. As the workmen have been instrumental in achieving this result they should share in the benefits. They should share according to their contribution. As their contribution has been in the reduction in labor costs per piece, they should be rewarded according to this element. Their reward should not be based upon the ultimate profits for many reasons, the foremost of which is that this element is not under their control. The company may have made some very unprofitable expenditures, may have entered upon an extensive advertising campaign, may be reaping the benefits of previous expenditures, or any one of a number of conditions over which the workmen have no control may affect the ultimate profits. However, the workmen have a great control of the labor cost per unit of output and should share in the benefits.

A workman employed for $4 per day might, under the old conditions, produce 100 of a given article per day, while under effective organization he might produce 150. It would not be just to the man to pay him $4 for the 150 pieces, and it would not be just to the company to pay him $6, as the company may have expended $10,000 to assist the man in increasing his production. No hard and fast rule can be made to apply in all cases.

A bonus system must be devised for each concern which will suit the conditions and give a fair return to both the workmen and the company. It is well in establishing standard times and deciding upon a bonus reward to consult the workmen. A committee appointed by them should be taken into full confidence and given all the information in the case. Where this has been tried a fair, equitable and satisfactory bonus system has been installed. In one concern all standard times and bonus rewards are established by the shop committee, but the president of the company reserves the right to veto their actions. During the six years that this method has been in operation there has not been a single veto.

Because the reward is very prominent it has been mistaken by many as the whole scheme. Men calling themselves efficiency engineers have sprung up all over the country and have installed "systems" which have met with disaster and caused great consternation among the workmen. Employers knowing only what they have read in magazine articles and books have also installed "systems" with similar results.

There has been some fear in the popular mind that the increased production would result in many being out of work, but history shows that this fear is groundless. Increased production and increased demand for consumption have always gone hand in hand with the demand one step ahead. The greater the production, the more of the good things of life each one can have and the gulf between prosperity and the bread line is broadened. The increased prosperity will also enable the children to be kept in school and out of the factories.

There is absolutely no quarrel between the workmen and effective organization.

Blanking, Drawing, Reducing, Piercing, Trimming, and Beveling a Shell

By F. J. G. Reuter

This problem was given to me by a manufacturer: "I want you to design the tools so that I can use two subpresses on single-acting presses for four different sizes of ferrules."

Fig. 1 shows a section of the first subpress. The operations done by it are to blank and draw a cup of sheet iron. This set of tools is constructed similar to any cut and draw tool with spring blank holder. The stripper is, of course, different. It is fixed to two rods, which are a friction fit in the base and a loose fit in the top block. The lower ends of the rods are screwed into a cross-bar, which sustains a knock-out *A*. At the end of the upward stroke the stripper and knock-out are flush with the blanking punch *B*, which is also the drawing die. In the downward stroke the stripper and knock-out keep their position until forced down by the blanking die *C* and drawing punch *D*. The motion of the stripper is due to

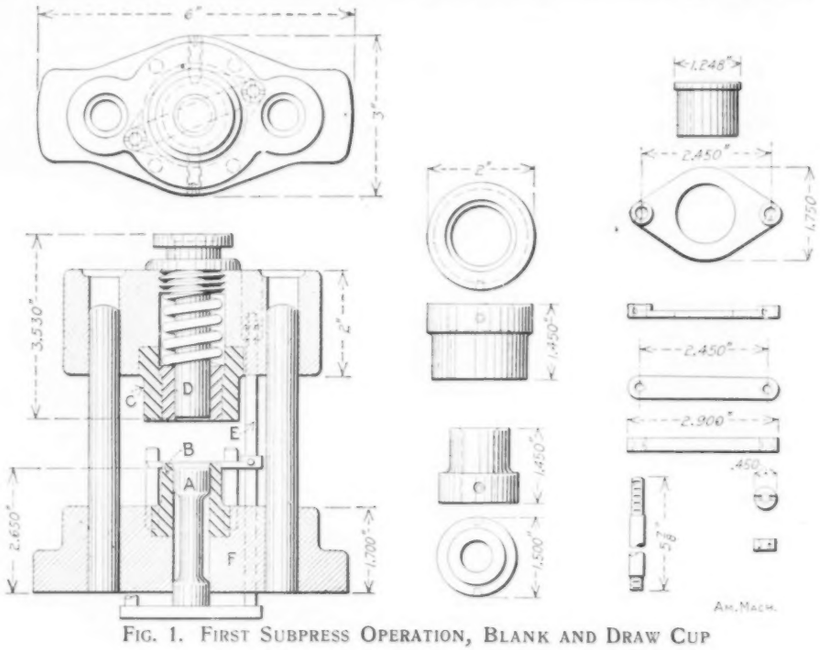


Fig. 1. First Subpress Operation, Blank and Draw Cup

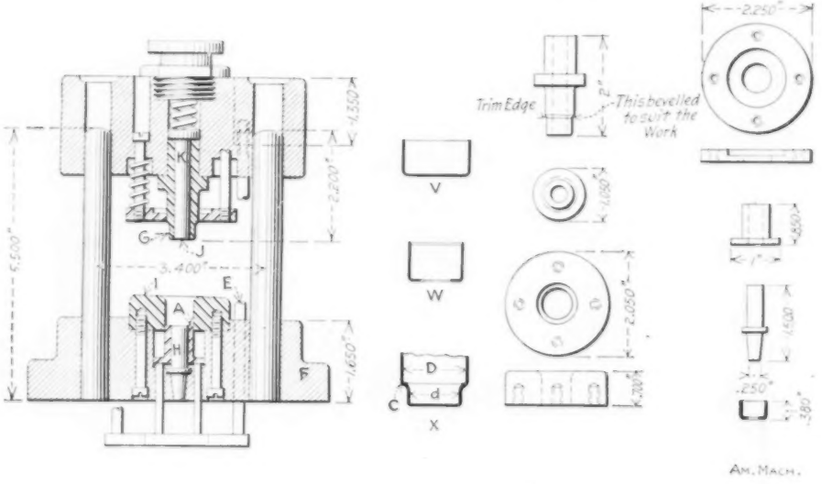


Fig. 2. Second Subpress Operation, Reducing, Piercing, Trimming and Beveling Edge

the friction of the connecting rods *E* in the base *F*. The cup from this operation is shown at *V*, Fig. 2.

The second subpress, shown in Fig. 2, is more peculiar because it reduces, pierces, trims and bevels the edge. The drawing shows the top block in the upper position and the parts in the base in the down position. Following the motions starting from the end of the upward stroke, the knockout is nearly level with the reducing die. A cup from the first operation is put in place and the upper block comes down; owing to the friction of the connecting rods *E* in the lower block *F* the knockout *A* keeps its place until forced down under the pressure of the reducing punch *G*. While being reduced, the cup assumes the shape shown at *X*, Fig. 2. Gradually as the punch goes down the diameter *D* becomes diameter *d*. The punch is not quite down when the piercing punch *H*, which is in the bottom of the reducing die *I*, pierces the shell and forces the piercing scrap into the piercing die *J*, which is the hole in the reducing punch *G*, just after the corner *C* in the detail *X*, Fig. 2, strikes against the edge of the punch marked on the detail "trim edge." At this point the diameter of the punch exactly fits the reducing die and the over length of the shell is cut off; the edge also must take the shape of the fillet marked on the detail "this beveled to suit work." At this time the knockout is all the way down to the bottom; the ferrule sticks around the piercing punch *H* and inside the reducing die *I*.

With these conditions the reducing punch will not pull the shell out. At the upper end of the connecting rods a nut has been provided for adjustment so that the knockout will not engage the work before the reducing punch is entirely out of the die. Under the action of the spring stripper the trimming is left on the die; this is considering the upper motion. The knockout pushes the shell containing the piercing scrap, which has been forced out of the piercing die *J* under the action of the spring knockout *K*. At the end of the upward stroke the trimming, ferrule and piercing scrap are on top of the die. In placing the next cup the last one is pushed out of the way. If it is desired to make another size of ferrule, the few parts which have to be changed can easily be replaced by those required for the desired size. Tools of this kind are easy to set on the presses; they always line up and last a long time in perfect condition. The finished ferrule is shown at *W*, Fig. 2.

Working or Unit Stresses for Design

By A. S. Trawe

The satisfactory determination of the unit or working stresses to be adopted in the design of structures and machinery is a matter of great importance, although in some respects of considerable difficulty. However much designers may differ among themselves as to the usefulness of various theories and formulas for determining the strength of a portion of a machine or structure, they usually accept without a murmur the working stresses upon which the calculations are based.

Many investigators have in recent years attacked the question of the strength of elastic materials when subjected to combined tensile or compressive and shear stresses, and the result of these investigations has been to show that the theory in most common use, namely, the Rankine theory, compares less favorably than others with the results of careful experiments. Now it so happens that the relative values of the working stresses for an elastic material, such as wrought iron or steel in tension, compression and shear, depend theoretically upon this question of combined stresses, and that strangely enough the theory upon which these working stresses have usually been based in the past is not the Rankine theory, but what is known as the St. Venant or French theory, and neither of these appears to be the correct one.

If these recent investigations are accepted as final, then the shear stresses usually adopted in design are too high for the tensile or compressive stresses.

The usual plan is to take the shear stress as about four-fifths of the tensile stress; figures very commonly adopted for mild steel are 15,000 pounds per square inch for tension and 12,000 pounds per square inch for shear. According to the theory now advocated, the shear stress should be taken as one-half of the tensile stress, and this is considerably less than the figure adopted. It will be seen, therefore, that this question of compound stresses is an important one, because it affects the working stresses adopted in nearly every design. It requires careful consideration and discussion by practical men engaged in designing as well as by scientists who view the question from the academic standpoint.

Three Theories

We will consider shortly the various theories which have been advanced in order to appreciate the point more clearly. The principal theories are three in number, namely:

(1) Rankine, or principal stress theory.
(2) St. Venant, or French, or maximum strain theory.
(3) Guest, or resultant shear stress theory.

The following notation will be used:

f = Tensile stress per unit area;
s = Shear stress per unit area;
F = Resultant tensile stress equivalent to the compound stress;
S = Resultant shear stress equivalent to the compound stress;
f_T = Safe working stress in tension;
f_s = Safe working stress in shear.

1. *Rankine Theory*—This theory is usually attributed to Rankine and will be found in nearly all text books dealing with the strength of materials. It is obtained by considering the resolved components of the various stresses acting across various planes and finding the value of the resultant stress across the plane where such resultant stress is wholly tensile. The value of such tensile stress is given by

$$F = \frac{f}{2}\left(1 + \sqrt{1 + \frac{4s^2}{f^2}}\right).$$

This is the theory most commonly used in practice in cases where such compound stresses occur; for example, the design of a crank shaft with an overhung crank. In the limiting case where $f = o$, this gives $F = S$, or putting this into working stresses, it becomes

$$f_T = f_s.$$

2. *St. Venant Theory*—This formula is due to the famous French engineer whose name it bears, and is obtained by considering the compound strains on various cross-sections, taking into account the lateral strains according to Poisson's ratio. According to this formula,

$$F = \frac{f}{2}\left\{(1 - \eta) + (1 + \eta)\sqrt{1 + \frac{4s^2}{f^2}}\right\},$$

where η = Poisson's ratio. The usual value taken for this ratio is ¼, and with this value the formula becomes

$$F = \frac{f}{2}\left\{\tfrac{3}{4} + \tfrac{5}{4}\sqrt{1 + \frac{4s^2}{f^2}}\right\}.$$

Considering as before the limiting case where $f = o$, the formula reduced to the value,

$$f_T = \tfrac{5}{4} f.$$

This is, as has been indicated above, the formula upon which working stresses are usually based.

3. *Guest Theory*—This formula is named after J. J. Guest, who carried out some of the earliest experiments on the subject and suggested its use in design. It is based upon the consideration of the components of the component stresses upon various planes, the value being found where the shear component of the compound stress is a maximum.

According to this formula,

$$S = \frac{f}{2}\sqrt{1 + \frac{4s^2}{f^2}}.$$

The limiting case to consider in this case is that in which $s = o$, when we get

$$f_T = 2 f_s.$$

Summarizing these results we get

$$f_T = f_s, \quad (1)$$
$$f_T = \tfrac{5}{4} f_s, \quad (2)$$
$$f_T = 2 f_s. \quad (3)$$

Experimental Work

Guest's experiments were carried out in America and the results were published in the *Philosophical Magazine* of July,

1900; tubes were used and some were subjected to combined bending and torsion and others to combined tension or compression and internal pressure. The strains for various stresses were measured carefully and the stress at the elastic limit was compared with the stress at the elastic limit for pure tension.

This comparison of the elastic limits has been used by all the experimenters under notice and appears to be the only reliable criterion. It is gradually becoming recognized that working stresses and factors of safety should be based upon the elastic limit rather than upon the breaking stress, because the theories upon which the formulas for the strength of beams, shafts and so forth are based, are true only so long as the stress is below the elastic limit. Anomalous results are obtained if the breaking strengths of beams and so forth are compared with the breaking strengths of tension bars of the same material.

Professor Hancock, of Purdue University, followed in America with tests on tubes and solid bars in combined tension and torsion; his results were published in 1906 in papers in Volumes XI and XII of the same magazine, and were in good general agreement with those of Guest, but although his apparatus was more accurate than that of Guest the results were not quite conclusive according to a paper by Professor Smith in *Engineering*, of August 10, 1909. In the same year W. A. Scoble published the results of experiments made in Great Britain on combined bending and torsion, the results being in favor of Guest's theory, although as in Guest's and Hancock's experiments, there was some considerable variation in the individual results.

In 1909 very careful experiments were made in Great Britain independently by Professor Smith, of East London College, and Laurence B. Turner, B.A., of Cambridge University. Great care was taken in these experiments to get the true elastic limit. The first experimenters were satisfied with a determination of the "yield point," which occurs some time after the elastic limit. Experience in recent experimental work of this kind has shown, however, that the interval between the elastic limit and the yield point is a variable one depending on the nature of the loading, and to some extent upon the shape of the specimen.

The true elastic limit is taken as the point where the stress-strain diagram leaves the straight line, and to get uniform results very great care has to be taken in the measurement of the strains, which are, of course, very small, and require very great magnification for their measurement. This can be seen quite easily by testing a mild-steel tension specimen and a beam of the same material; in the case of the tension bar, if the extensions are plotted against the loads the yield point will be found to occur shortly after the elastic limit; but in the beam, if the deflections are plotted against the loads, the yield point will be found to occur at a considerable interval after the elastic limit, the variation of the stress across the section having the effect of delaying the yield.

If, however, the stresses in the beam and tie rod are calculated for the various loads, it will be found that the elastic limits for tension and bending agree quite well, but the yield point will be higher for the beam than for the tie rod.

This fact accounts in part for the lack of uniformity in the results of the early experiments, because Messrs. Smith and Turner found considerably less variation in their results. Mr. Scoble produced back the stress-strain curve after the yield point to meet the straight portion of the curve produced, thus getting a kind of theoretical yield point, but this is not so satisfactory as taking the true elastic limit.

Mr. Smith's experiments were carried out with considerable care and extended over a very large range of variations in the stresses; they were subjected to searching criticism by advocates of the Rankine theory, but the figures appear to be quite conclusive in favor of Guest's theory.

Mr. Turner's experiments were of special interest, because he appears to have been the first to realize that the question could be settled really by a very careful determination of the elastic limits in pure tension and pure shear. He used thin tubes and subjected them to torsion to get the shear and found that the elastic limit in shear only was almost exactly one-half of that in tension only. As has been indicated above, this result follows from Guest's theory, so that there appears now to be little doubt that this theory is the most nearly correct.

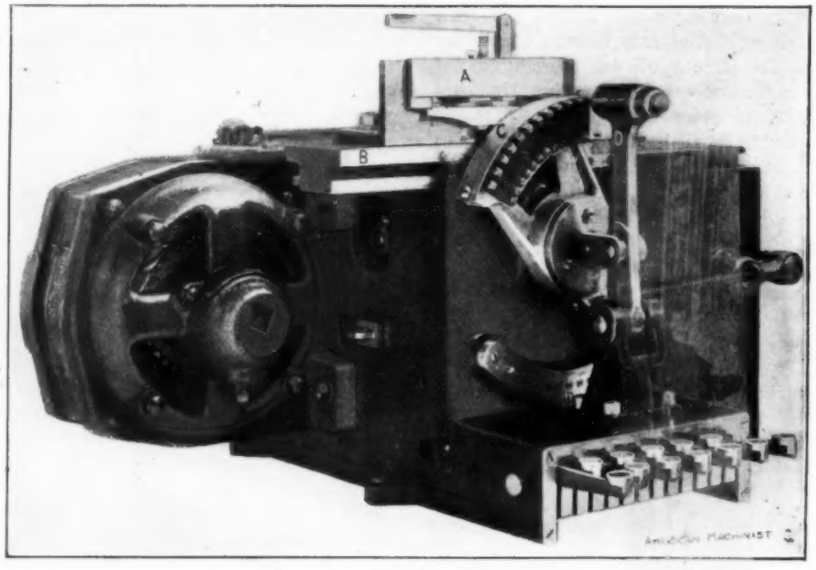
Effect on Practice in Design

From a practical standpoint, the important question with regard to these experiments is as to whether designers will in future allow smaller working stresses in shear. This matter requires a thorough investigation, and should claim the attention of practical men, because it is very necessary for economical design that the factor of safety of every portion of a machine or structure should be practically the same. If the Guest theory is correct, as these experiments certainly indicate, then in a bridge truss the factor of safety of the rivets as regards shear is less than is allowed for, so that relatively the rivets are the weakest part of the structure.

This appears to me to be a point which is both interesting and important, and which is worth the attention of all engineers engaged in designs which involve calculations as to strengths of various parts.

Name Plate Stamping Machine

A very ingenious name-plate stamping machine made and used by the Lynn works of the General Electric Company is shown herewith and although one of considerably larger capacity is now being built, this will serve to show the principle on which it acts. The name-plate to be stamped is clamped very easily in the holder *A*, which is mounted on the slide *B*. The numbers and characters are on the other end of the individual stamp shown in the arc at *C*. A depression of a key swings this arc until the character depressed comes into position under the hammer *D*, and a further depression releases the hammer and drives the stamp into the name-plate, the force of the blow



NAME-PLATE STAMPING MACHINE

being entirely mechanical and the whole machine being operated by the small motor shown.

As the hammer retracts the carriage automatically moves along one space and can be spaced as desired in addition to this by separate spacing teeth. This makes a very compact machine and one which is capable of turning out a large quantity of work in the hands of a skilful operator.

The position of the character to be stamped is located by an index pin at the lower end of the arc, which is hidden behind the lower hammer bracket, the index pin seating in one of the hardened bushings, shown on the lower arc.

Industrial Education Methods

By E. H. Fish*

The estimated commercial value of trade education is sixty times its cost.

Two features of such training that are open to question are: the so called all-work period and the project system.

A school should aim to turn out all-around workmen.

*Manager, Worcester School of Trades.

In discussing Mr. Haight's article on page 415, I wish to assure the readers of the AMERICAN MACHINIST that I saw nothing in his original article which singled me out or that attacked the Worcester Trade School, but I did see that in it which I regarded as dangerous to the progress of industrial education if it were taken seriously. I also realize that at this time there are a great many people looking for light in this direction and that many of them are not in a position to discriminate between good and bad education from the standpoint of the mechanic. The readers of the AMERICAN MACHINIST are in no way interested in any personal difference of opinion which Mr. Haight may feel to exist, and I decline to be drawn into any personal discussion.

The question of the possibility of teaching a trade in a school or shop seems to me one that can have only one answer. It has been done for years. I have just returned from a visit to Hampton, which is only one of a dozen of similar schools, of which Tuskegee is the best known, where colored boys are being taught trades. They simply have to teach trades or do nothing industrial. The colored boy cannot get a chance to learn a trade in a shop. If he knows a trade he can get a job for exactly the same reason that white men can, because he has something to offer that other people want! But race prejudice is so strong that apprenticeship is closed to him. If anyone doubts the ability of the school to teach the negro a trade, let him go and see it done.

They not only teach them a trade, but they pay wages while the teaching is going on, and on top of that they show a per capita cost of doing it that will discount every industrial school in the North. If this can be done with colored boys, where is the man that wants to stand up and say that we are incapable of doing as much for a white boy, or that the white boy is less capable of being taught? Again this thing has been done year in and year out in State prisons, reformatories and truant schools, with the scum of society for subjects. Industrial education is nothing new. What we are just finding out is that there are some people outside of Indians, negroes and criminals who need industrial education at the expense of the community.

The question of whether a shop can teach a trade is too absurd for discussion, for there is no definition of a trade that does not assume that it is the practice of some shop. If a trade is what is practiced in shops, then shops teach trades or else there are no shops and no trades. No one ever learns all there is to any one trade, but that condition is common to every activity of life. Would Mr. Haight deny that a school could teach spelling simply because he hired a stenographer who missed a few words occasionally?

Then too, in laying out methods of instruction for a trade school, we can hardly afford to overlook the fact that the Indian and negro schools, and others as well, have had years of experience. We are simply dealing with material that had a better fighting chance in the beginning. These schools have had the advantage that they could with impunity kick over the traces of public-school methods because the public-school clique read them out of the fold before they got in. There has been no fatuous effort to find a pedagogical aspect to their methods. They have simply gotten down to brass tacks and taught trades without suspecting that their methods were susceptible of analysis. Their method is to teach a boy to do work as he has to do it in a money-making establishment of today. They teach by doing, on the other hand they do not hesitate, nor do hard-headed employers hesitate, to give a boy practice work when that is the best way to save waste. My father was one of the most intensely practical men that ever wore shoe leather. He ran a blacksmith shop for 60 years, and never thought of such a thing as having a boy start in to make welds on work he was going to sell. The boy welded scraps of iron together at odd times for months before he was allowed to weld anything of consequence. When he was put on welding work it was because he could weld. The boy did not kick, for one thing because he knew better, but also because he knew that just as soon as he passed the point where 99 per cent. of his welds held he could get on a fire regularly. This is no argument for the exercise work of the manual-training schools because it leads up to something useful, but it is a scheme that is used in many other forms in shops where trades are still taught by the modern apprenticeship system, which is really a private trade school with the same aims and motives.

COMMERCIAL VALUE OF A TRADE EDUCATION

Another very good reason why the New Bedford plan, as outlined by Mr. Haight, should be tried with the utmost caution is the magnitude of the experiment. If a trade-school education does not increase the earning capacity of the average boy by a dollar a day over what it would have been without some form of apprenticeship, it can hardly be considered a great success. A boy graduating before 20 years of age has an expectation of life, according to the insurance companies, of something over 40 years. We are in the habit of valuing a business by the amount of capital on which it will pay 5 per cent. If a graduate of one of these trade schools should earn his dollar a day extra and invest it at 5 per cent. for 40 years, he would have a comfortable little nest egg of $35,000 and some odd. If out of the 500 or more boys now attending the trade schools of Massachusetts alone 200 should graduate, the resulting accumulation of savings would reach the sum of $7,000,000. The methods of the already existing trade schools which have years of experience back of them will easily produce this result. Can any community afford to jeopardize the large value of industrial training for the sake of exploiting some local scheme that has never been even tried out to a conclusion in that locality?

The two dangerous experiments which are concealed in Mr. Haight's article, but which are being exploited for State wide use are these: Beginning school training

with an all-work period so called, but which appears to be an all-play period; and the project system of doing work in the school shop.

The All Work Period

The all-work period is introduced for the sake of giving the pupil a taste of shop life; he is supposed to spend his time in the shop without specific duties or instruction, and in defiance of the time-tested adage that Satan finds mischief for idle hands to do, absorb shop atmosphere and get a background of shop knowledge. He may during this time watch the older and more experienced boy and we are told he is also allowed to talk with these older boys during times of relaxation, about mechanical matters. Of course, this last suggestion probably does not appeal to the readers of this paper so strongly as it does to men who are not brought in contact with real live boys and shop conditions.

The American boy plays while he plays whether he works while he works or not. He may assist the new arrival to join in a search for a left-hand monkey wrench or a rubber drill chuck, but that is about as far as his thoughts follow his work during "periods of relaxation." These boys have a decidedly dual nature. They are irresponsible, a condition for which the lower schools are largely responsible. The serious-minded youth like Benjamin Franklin or Booker Washington are just as few and far between as ever, but on the other hand they have a keen sense of values. They and their parents look on their work in the shop as working for nothing. If they think that they are being exploited they have no hesitation in bringing backing from home to have things changed. If they do not get to working at the specific trade that they were sent to school to learn in short order we hear from it at once. These parents say that if the boy cannot be working at that trade they prefer to take him out of school and put him where he can be earning something.

This is exactly right. It is the job of the public trade school to make this boy as competent a mechanic as possible with as little economic waste as possible. It is not enough for us to figure, as I did above, that the real value of a trade education is around $35,000 and that the cost to the community is only about $600. The cost to the parents is measured by the earning capacity of the boy during his school course. This averages around $1000, which is insignificant as compared with the value of the education, but it is an absolute bar to the larger part of the boys for whom these schools were established, for the simple and convincing reason that they haven't got it. Can we wonder if boys resent being kept sweeping shop or running errands, or that their parents object to their standing around the shop with a constant temptation to mischief when they are making daily sacrifice to keep the boy in school at all?

In this connection Mr. Haight scouts the idea of a boy's being able to do good work his first day in the shop, and cites the very case that I would use to prove my point, that of a man who has drifted around from one shop to another, never being taught the trade and who as a consequence has never acquired correct habits of working. It is really the simplest thing in the world to stand a boy in front of a lathe and set him to doing straight turning to size, and get results within a thousandth of an inch or even closer before night. It is not even necessary to teach him to read a micrometer in order to do this, as the micrometer may be set for him and he may be taught to read a few thousandths each side of the set measure. Respect for fine measurements is as easily taught the first day as the last. Of course, if we did our measuring by transferring from a scale or a sample with spring calipers, and if we finished with a file instead of a grinder, we could not do this. But we prefer to teach the boy to use modern uptodate methods first, and later when he has proved himself able to handle work in a regular ship-shape way we will teach him to get along in an emergency with whatever tools he may be able to find in any shop he may drift into.

The Project Method of Instruction

The second dangerous item in the New Bedford scheme is what is known as the project method of instruction. Briefly this scheme involves the following stages of progress in each job given the pupil: Conception, design, estimating, drawing, ordering of materials, selection of methods of manufacture, selection of tools and implements, performing of all operations on the job, keeping time and cost, comparison with original estimate. I may have skipped a few things, but these are the principal ones that are to be given in a school which cannot legally discriminate in favor of boys over 14 years of age!

To take a concrete example, we will say that we find that we need a shafting straightener, that being about as simple a machine can be dignified with that name. First comes the conception; the young man who is assigned the job is told to investigate the needs of the shop in the shafting-straightening line and to write an essay giving the results of his investigation. This essay he submits to the teacher of English for correction. He then submits it to the chief designer and resubmits it until it is satisfactory. The result of this effort, we will say, is to show that a shop is in crying need of a shafting straightener of a capacity to take in 3-inch shafting, and from that down to ½-inch.

The boy then tackles the design. First he goes to the teacher of mechanics and gets from him instruction how to find out how much it takes to spring a 3-inch shaft. Of course, it being understood that the machine is wanted for use and not merely to talk about, this instructor will have to give the boy a formula and let him figure the thing out blindly. No such thing as leading a boy up gradually to the point where he can intelligently discuss the question is possible. Having gotten this formula from the chief designer, the boy now goes to the department of mathematics to be taught how to use this formula, for it is proposed to inflict this project scheme on boys who have absolutely no grounding in mathematics beyond a speaking acquaintance with the multiplication table.

Having discovered the necessary pressure which the straightener must exert, he tackles the design of the frame, going again to the chief designer who gives him some standard work on the design of curved members to peruse during his periods of relaxation. The boy having discovered that the thing is absolutely beyond him without calculus, gets desperate and either goes home to mother or else learns that most important feature of designing and bluffs. Having gotten the shape of the press to suit the designer, who is also bluffing, he proceeds to design the screw. This being a comparatively simple matter involving only such matters as the torsional strength of a shaft, pressure per square inch on a thrust bearing, strength of a continuous helical cantilever, etc., he will undoubtedly be able to get by the chief designer by the same method. Or possibly he will just go and copy some other shafting straightener, and wonder why cribbing in an examination is so much morse than in the drafting room. Omitting the rest of the harrowing details of this 14- to 16-year old design, and hoping that it will be done in time to escape the age limit of 25 years, which the law sets, we will pass to the estimating, which is very simple.

This is just a detailed guess as to how long it will take to make the thing and how much stock it will take to make it. Time is easy to guess on, there being no limit, but estimating of material requires a lot of individual work on the part of the teacher of geometry to teach this particular boy to compute the volume for all these irregular parts.

Next he rolls up his overalls to make a nice cushion and sits on the bench to make the drawings. He is not allowed any preliminary practice in making working drawings, his acquaintance having been limited to seeing the blueprints lying around the shop during his all-play period. He is now initiated into the making of the particular drawings that are needed for this machine, and in the course of time evolves something that passes for a drawing. The work that they

showed me in New Bedford indicated that the principles of drawing are side-stepped for the sake of a quick superficial showing.

Now he orders his materials, or rather goes to the pattern shop and makes his patterns. No time again to study the principles of molding, but only time to get out a pattern that suits an instructor. He goes to the steel warehouse and negotiates for a fractional bar of steel for the screw, and another for the lever; he goes to the screw shop and investigates the cost of screws to put the thing together with. When the pattern is done he bears it in triumph to the foundry, and discusses the percentage of silicon that will give the maximum strength for a given weight of casting.

Having written a report of his experiences in getting his materials for the inspection and approval of the teachers of English and all other subjects whom he has consulted, he proceeds to write another essay giving his best efforts to arranging a method of manufacture. To be sure there has been no preliminary instruction in the use of any tools or machines, except such as have come from previous projects, but he sets manfully about this and, knowing that whatever he writes will be wrong, soon presents something for the inspection of the machine-shop superintendent. Having revised this to suit the latter, he does the same thing regarding the tools that he will need. He has to consult the teacher of trignometry as to the method of finding the angles at which to grind his thread tool, and he has to take up the matter of cutting feeds and speeds with the instructor in arithmetic, but that is soon over. Then he is ready to square away on the home stretch with nothing much to do except make the thing.

This we can pass over rather hurriedly, as we are all familiar with that part of the game, only—here is a new idea—instead of having a boy who is used to lathe work do the lathe work, and another who is used to planer work do the planer work, this boy takes his work around the shop, dodging into the planer here and then into the miller, or the driller, and back and forth to the lathe, never having a chance to stay on one tool long enough to acquire any skill in its use, and always wondering what will happen if a handle is turned to the right or the shipper swung to the left.

Of course, if there are any moments of relaxation owing to the fact that every boy in the shop happens to have a little job to do on the only sensitive drill at the same time, he goes out to see the teacher of metallurgy and finds out how steel is made and cast iron grows under repeated heatings; or he hunts up the teacher of history and finds out how the steel-making industry has evolved, and how the Steel Trust violators of the Sherman law got off so easy. If in the meantime the boy on the driller has not finished his job he goes up to persuade the teacher of economics to teach him how it happens that steel rails cost less in Europe than in this country.

But then there is nothing but old age to interfere with his ultimately getting his machine work done and the cost figured up, and there you have him with a complete education all acquired by making a shafting straightener.

To be sure he has no dexterity, he has no ideas of the principles of mechanics, no idea of the underlying principles of drawing, of geometry, or even of economics or anything else. He has skimmed over the tops of a whole lot of things that his mind will not be mature enough to comprehend with any intelligence for years to come, but he has done it all in a way that appeals to the pedagog, and that is evidently all that some of these trade schools care about.

We did hope early in the advent of industrial education that these schools could be made independent of the public schools, and that men who were conversant with the trades from both employers' and employees' standpoints would take an active interest and control these schools. As the thing stands today these schools are independent in name only. The Worcester school is the only one in the State that has the type of board of trustees that the law originally contemplated, the rest of these schools are openly or quietly subservient to the domination of the old-time school committees and pedagogy reigns supreme, while mechanical sense is a side issue too insignificant to discuss.

Elements of the Project Scheme

Let us see what of the elements of the shop project there are that are needed by a man who aspires to become a top-notch machinist. First, there was the conception, then the design, estimating and drawing. Are any of these functions of a machinist? To be sure he is none the poorer machinist for being able to do all these things but is it fair to limit instruction and training in the trade to men of sufficient mental caliber to design? If we should, how many of these men would stay machinists? Is not this really technical training rather than trade training? Have we not enough third-rate technical schools now without adding to the number by representing to the public that we are teaching trades?

A man is to be praised for learning to draw, but thousands of men who have been led by the correspondence schools to learn mechanical drawing have found to their sorrow that it holds an empty promise. The rest of it is all good except the method in which it is applied. Who wants to hire a machinist who has not been taught and trained by constant repetition to do work correctly and quickly? This is the way work was done a hundred years ago, and by a curious coincidence it happens to be just a hundred years ago that this project scheme was first promulgated by one Johann Herbart, at Konigsberg.

Herbart set down as a rule that children should be educated by their contact with life, an extremely safe and sane rule, and one that has appealed to men of learning at all times since. The practical application of this rule as proposed by Herbart and as has been attempted by thousands of educators since to the time of Mr. Haight has met with uniform disaster. Herbart proposes that all instruction shall start with what the pupil knows and broaden out in all directions uniformly. For example, take one of his most practical studies, geography; he took his pupils out on a hill and taught them by that means what a hill was; he showed them brooks and rivers; he took them to a city and showed them a city. But his geography ended at the limit of their walking capacity. They were to be taught nothing of the cities or country beyond those they could come in contact with.

History was barred because it could not be repeated, but the pupil must wait till it repeated itself. If a pupil came upon a bit of stone he must go to the quarry from which it came and study the stone there; he must go and see the cloth woven for his clothes and must see the sheep growing and the cotton growing and ponder on the relative amounts being raised. Everything that he began must be followed out in its every ramification until it was a complete education in itself, since everything is more or less intimately related to everything else. It made no difference where the pupil began for the course of his study would lead him to every point in the realm of human knowledge.

Astronomy is a branch of machine-shop practice since the time of beginning work is set by evolution from the rising of the sun, and the north star aids us to determine the lining of the main shaft by the simple transition through the survey of the land on which the shop is built.

Times Have Changed

The thing that Mr. Haight and other advocates of the project system seem to overlook is that times have changed, that we are not living a hundred years ago, and that methods of training that were good then may not be good now. Today we have an intense subdivision of labor. A man may be an all-round machinist, but we hire him as a lathe hand. When business is slack in the lathe department we may be glad to transfer him to the setting-up floor to keep him with us. But that is nothing that is essential to the success of our business. The strong reason why men should become all-round machinists is that it gives them greater flexibility of employment and a better

chance of advancement. The man who can do only one thing often finds himself the victim of circumstances. He also finds that advancement is usually impossible.

A trade school should make as many all-around men as possible; not for the sake of the manufacturers who may employ them, but for the sake of the men themselves. Even then the all-around man is simply a man who has learned a number of trades that are really distinct.

The Massachusetts Board of Education has taken a very positive stand on the matter of the teaching of trades in series rather than in parallel. It is a school custom to have a pupil engage in a sample of every different activity during the day. These schools have in the past been inclined to divide the shop day between wood work, machine work, blacksmithing, etc., until the pupil was supposed to have had enough of a taste of each to be able to intelligently decide which he should take up for a life work. The State board very distinctly advocates the trial of these trades in series, that is, the giving of all of the pupil's time and attention to one trade for a time and then to another till such a time as he finds himself. If this influence can be made to reach its logical conclusion it will effectually destroy the project scheme, for that depends for its existence on the flitting back and forth from one point to another of the pupil during his whole course.

It seems to me that Mr. Haight overrates the mental grasp of the average boy. There are no doubt many boys that can follow such a course as he advocates, but it should be constantly borne in mind that boys of that caliber have risen in every walk of life since the world began. We have in the past confined our efforts in education to men who by sheer will power would inevitably have risen any way. The fact that some graduates of our schools have failed tends to prove that it is not so much to their credit that the rest have succeeded as it is to the credit of their selective process. The trade schools properly belong to the non-technically minded boy, to the boy to whom the exercise of dexterity appeals. These boys are entitled to an education in the things which relate directly to the trade which they are fitting for, and also to a general education fitting them for the position in our social and political life which they will enter.

Jig for Drilling Pulleys

By Charles K. Tripp

The accompanying illustrations, Figs. 1 and 2, show a jig for drilling standard pulleys. The machine is adjustable and the bushings and cones are interchangeable. The cones *A* are made to fit the inside of the pulley, the hole being bored concentric to the inside of the pulley, Fig. 3. The lower cone is raised by an eccentric; therefore, with one-half throw of the lever *B*, the cone can be raised sufficiently to clamp the pulley and the weight of the lever is sufficient to hold it in this position.

Figs. 4 and 5 show a wrench which I use for holding cylindrical work of any form in the drill press or lathe.

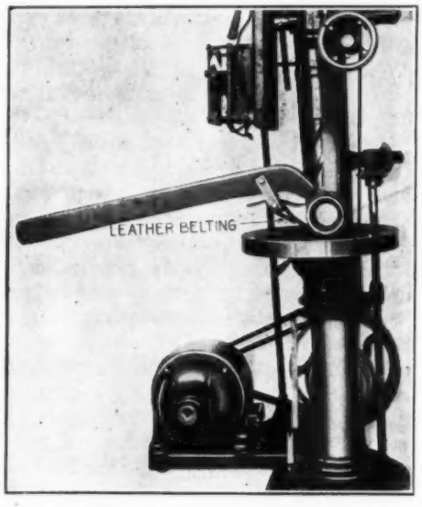


Fig. 4. Wrench for Cylindrical Work

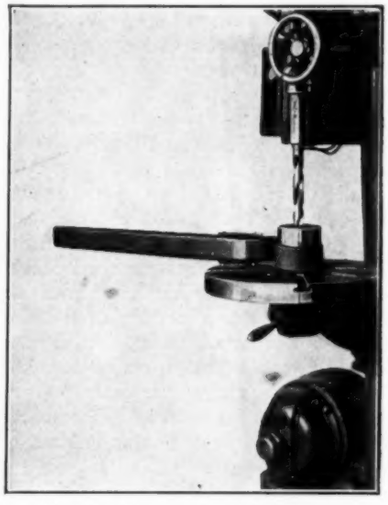


Fig. 5. Another Application

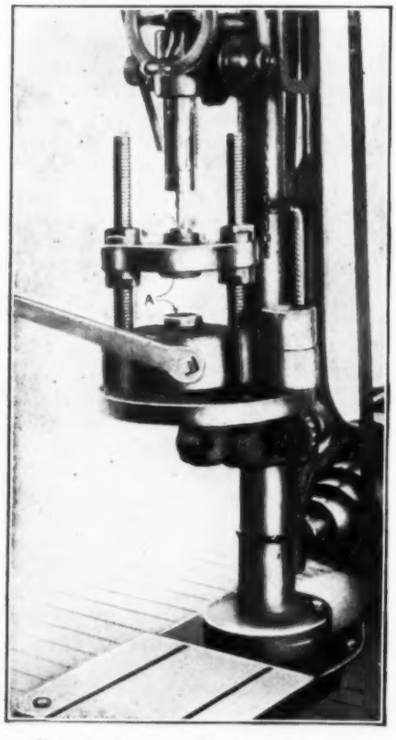


Fig. 1. Jig for Drilling Pulleys

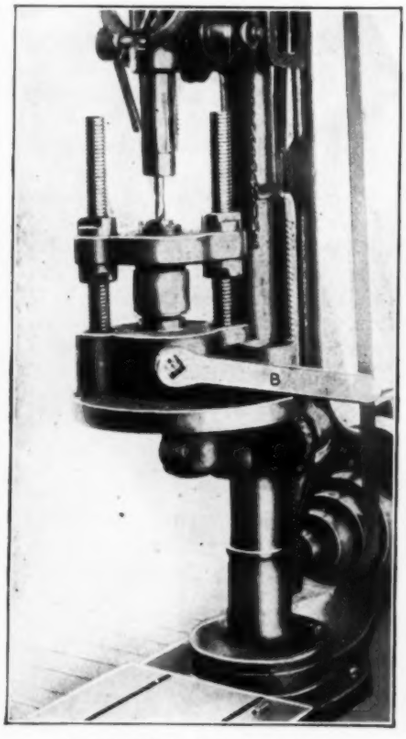


Fig. 2. A Pulley in Place

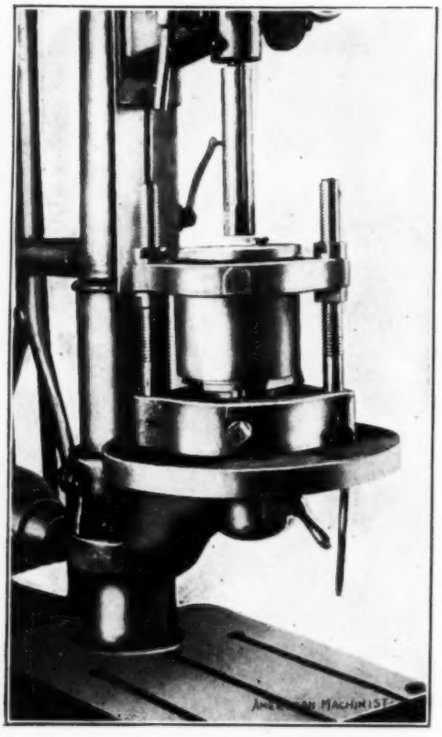


Fig. 3. Boring Hole Concentric

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

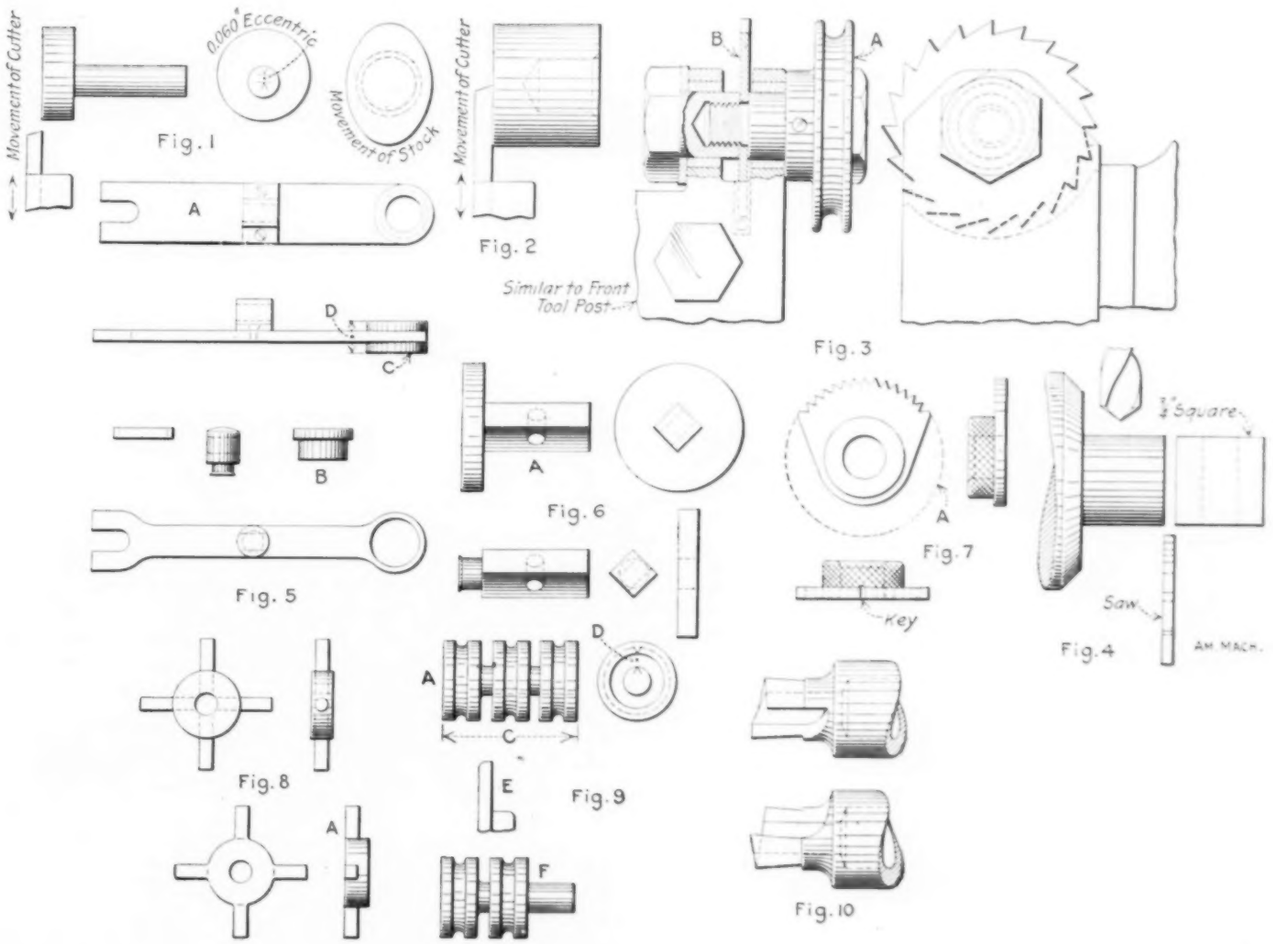
Some Designs that Saved Money

A successful manufacturer placed his best tool designer and mechanic in a position to save money by requiring him to make a trip through the factory every other day, making note of all suggestions, even from the most common operator. The designer soon learned whom among the workmen to avoid and the scheme was a success. The average operator making hundreds or thousands of parts a day should and usually does know more about the work than any executive, and the former can tell, especially if he is working piece work, how the work can be done more quickly and cheaply.

In the screw-machine departments, the cutting-off and forming of eccentric stock has always been a nuisance and the production very low; the reason for this is that very fine feeds are necessary for cross-slide tools owing to the pounding of the stock against the cutting edge. Even a fine feed will not give good results, as it tends to wear off the edge of the cutter. The method of eccentric forming, that is, forming a diameter off center, has been previously discussed in these columns, but what I wish to describe is the use of the eccentric collar on the spindle for operating the cutoff tool on parts that are held in an eccentric chuck. In this way, a uniform cut all the way around the stock is produced and the blow that ordinarily is struck against the cutting edge is eliminated.

The use of this method, Fig. 1, increased the production 100 per cent. The stem is formed from the turret where the conditions of cutting are not very different from ordinary work, excepting that the amount removed on a side is not uniform; also a heavy-lipped, hollow mill is used, but with a cross-slide tool we have only one cutting edge.

Another example of saving money on cutting-off operations is shown in Fig. 2. The foregoing explanation of the method



PIECES THAT EFFECTED ECONOMY

applies to the oval stock also, except that an oval collar was used on the spindle instead of an eccentric one. It should be noted that slower speeds are required, but this is accompanied by a coarse feed; on the parts shown a chip of 0.0025 inch per revolution was used but the surface speed did not exceed 70 feet per minute.

Fig. 3 is an illustration of the No. 2 Brown & Sharpe automatic screw machine being used as a miller. This is a very unusual case for the reason that the spindle does not revolve at all but is clamped dead the whole time the machine is running on the job. The old operations were: Cut off, automatic screw machine; drill hole, on drill press; and, as the cutter would not hold up in cutting the corners, the cutoff operation was removed to the milling department. The new method, as shown in Fig. 4, completes the piece in one operation by the use of the cross-drilling attachment. The output was increased in quantities that saved from 150 to 200 per cent. This will be understood when it is noticed that the cutting off and drilling are accomplished simultaneously, Fig. 4, and that the handling required to complete the piece is entirely automatic.

Fig. 3 shows the saw that is mounted on the front slide and is driven by the round-belted pulley; the saw is shown at *B*. This saw is 2½ inches in diameter and has 20 teeth; it was run at 74 revolutions per minute, which equals 50 feet per minute surface speed. The feed per tooth was 0.005 inch.

I will now treat the design or rather the mis-design of parts. Fig. 5 is a fair example of the work done by designers who have not had machine-tool experience and who are not willing to confer with those who have had. At *A* is shown a lever which carries a small bracket in the center and a hole in the end; this hole is not a bearing, but the thickness D was required; to get this thickness, the washer *B* was pressed into the hole and the washer *C* forced over it. Now, since the thickness *D* was all that was required, the design was changed and two washers like *C* were used. The bracket was changed to a screw-machine piece, thus completing it in one operation instead of four. This little bracket was just as serviceable and the use to which it was put did not cause it to twist; the new bracket also allowed the lever to be lightened as seen.

Another case of poor design is seen in Fig. 6. The piece in use has very little strain applied to it; yet it was designed solid as shown at *A*. This required screw machining the stem to a diameter and then milling the four sides flat, after which the hole was drilled in the drill press. If the manufacturing had been considered, the piece would have been designed as it is now, in two parts, one of which is blanked and pierced and the other completed (hole and all) in the automatics from square stock, after which they are riveted together. One can easily imagine the expense saved by such a change. When riveted together the square stem is pressed into the head slightly, which keeps it from twisting.

Fig. 7 is an expensive piece which was worked just the other way about; it was found cheaper to complete from one piece. The old list of operations were: Blank and pierce the wing, screw-machine the hub, rivet the two pieces together, and key with a small pin. The improved method is to form the whole piece on the screw machine, as shown by the dotted line *a*. It is then blanked to the finished shape; this not only eliminates the operation of assembling the two parts, but it also does away with the drilling of the keyhole and cutting off the small key pins.

Fig. 8 had always been made from five parts; namely, a cross- and center-drilled bushing with pins driven in 90 degrees apart. The new method not only saved labor and time but the desired location of the pins or arms had never been obtained when the pins were used, on account of the pin holes being too near the edge of the new location, as shown at *A*. The piece is now first formed and cut off and the hole drilled, after which it is sent to the press department for blanking out between the arms. The rectangular shape of the arms was preferable to the round and it was never required to replace them for wear.

A suggestion for the economical use of material came from a boy helper in the automatic machine department. In Fig. 9 is shown three parts that had always represented two different jobs. It was decided that it would be considerably cheaper to manufacture the three parts from the same bar. This balanced up all right, as the collars were used in greater quantities than the piece *A*. Also, time would be saved in revolving the turret, etc., and again in forming the three grooves in one cut. In operation, the stock is fed to the length *C* and the cut *D* is made only as deep as the length of the first collar. To make this cut we use the one-lipped, hollow mill shown in Fig. 10. This cutter will hold up with a very heavy feed for undercutting, which would be almost impossible with a three- or four-tooth hollow mill.

After the undercut is made, the cutoff tool *E* advances and cuts off the collar. The stock is now fed forward to the position shown and the hollow mill again makes an undercut; this time it must travel further on account of removing the fillet *F* left by the cutoff tool. The second collar is withdrawn from the stem by a special tool held in the slotting attachment. The stock is now fed again, and the stem is cleaned up by box-tooling while the cutoff tool is advancing part way; as soon as box-tooled the piece is separated from the bar.

Chicago, Ill. S. N. BACON.

Use for Old Hack Saw Blades

The following method of employing old hack-saw blades as scraper blades makes it unnecessary to send scrapers to the blacksmith shop to be redressed.

The cuts are almost self-explanatory. Fig. 1 is the hack-saw blade, which has

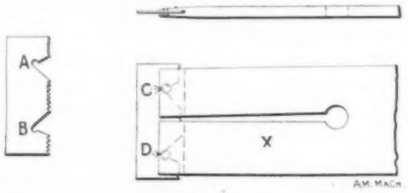


FIG. 1 THE SCRAPER FIG. 2

been cut off to the desired length with a thin emery wheel. With a dish-shaped emery wheel the two notches are ground to the shape shown and such a distance apart that the circular grooves at *A* and *B* will fit the pins *C* and *D* in Fig. 2 before the blade holder *X* springs out into its normal position. The tension on the lips of the blade holder will hold the blade in place.

The construction of the blade holder is shown in Fig. 2, which also shows the blade in position. For this an old file can be used that has been annealed on the end. The slots shown, one for the blade and one separating the blade holder into two lips, are milled. The holes for the pins *C* and *D* are slightly countersunk so that the pins can be riveted in position.

To insert a new blade it is necessary only to pinch the lips together in a vise, remove the old blade, insert a new one and release the vise.

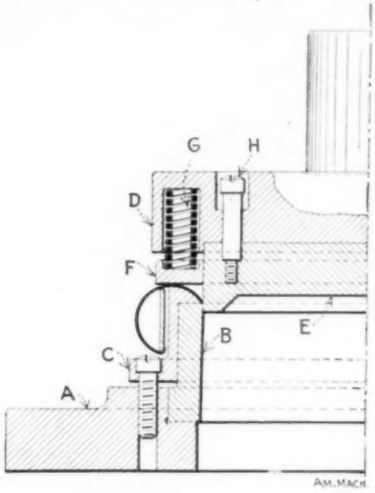
Cincinnati, O. R. G.

Center Piercing Die for Lamp Door

In making a round-type lamp door, having a band within it, fastened there by closing in the inner edge around the band, it is desirable to leave the center or bottom portion of the door punching intact until all operations of curling and closing are completed, for the sake of greater strength during these operations. The center portion is then blanked out with a die of the construction shown in Fig. 1.

The base *A* is a circular iron casting, bored out to receive the hardened tool-steel die ring *B* which is held in place by the ring-shaped clamp of soft steel *C*. The upper part of *C* forms a cradle, having a shape fitting the inner surface of the lamp door and the door must, of course, be able to drop down over the ring and be free on the sides in order to centralize well.

The punch holder *D* is of cast iron, having a stem bored out below to take the center piercing punch *E* of hardened tool steel. This piece is recessed below to obviate the necessity of grinding the entire



CENTER-PIERCING DIE DIE FOR LAMP DOORS

lower face each time when sharpening and is held to *D* by screws as shown.

A stripper ring *F* of soft tool steel encircles the punch *E* and is limited in travel by the shouldered screws *H*. Helical springs *G* in pockets in the under side of *D* serve to press the stripper ring downward on the work. The lower ends of these springs are let into the upper surface of the stripper ring to prevent them moving out of position due to continued extension and compression.

This type of die is easily made and by simply removing the clamp ring *C* the upper surface of the die ring *B* is exposed for grinding.

Detroit, Mich. ARON LAWRENCE.

An Angle Cutter Grinder

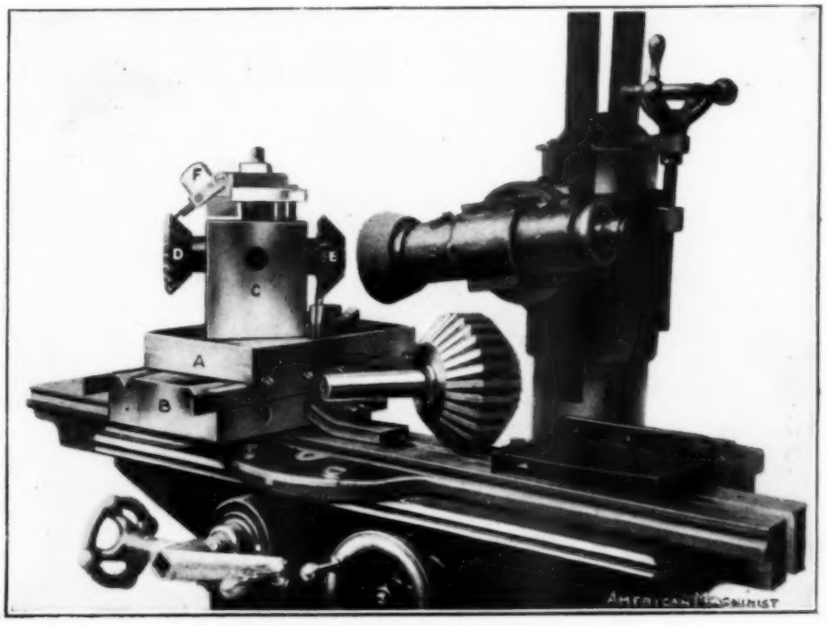
We have a number of 45-degree angle milling cutters to grind at frequent intervals and as the cutter grinder we have is somewhat worn, the only way to grind the correct angle was to grind and try, thus making the set-up the longest part of the work. Hence, to shorten the setting-up time, I designed the fixture shown in the halftone which requires practically no setting at all, it being necessary only to bolt the fixture on the machine somewhere near square, tilt the wheel, put on a cutter and grind.

The fixture is made as follows: The bottom part is made of two pieces of cast iron *A* and *B* about 6x12x2 inches, which have V's like a planer and slide together. The top part *C* is a piece of steel 4 inches square and 6 inches high, made perfectly square and having two 1-inch holes bored clear through at right angles to each other and the same hight from the bottom. This square piece is screwed and doweled to the top slide *A* so that its faces are exactly 45 degrees with the travel of the slides.

The spring rest can be bolted on to the top slide in any convenient position and the top of the spring set even with the center of the hole, the clearance being obtained by tilting the wheel head. Various sized arbors can be made for different mills, the shanks, of course, being the proper size to fit the bored holes in the fixture. The ways are protected from dust by sheet-steel guards, one of which is removed to show the V's.

The two mills *D* and *E*, shown on the grinding fixture are a pair, the diameters of which must be alike and the lengths of angles the same. The long angles are ground first until the indicator *F* reads the same on both cutters, thus showing these long angles to be the same diameter, then the short angle is ground until the long angle is the correct length, which completes the operation.

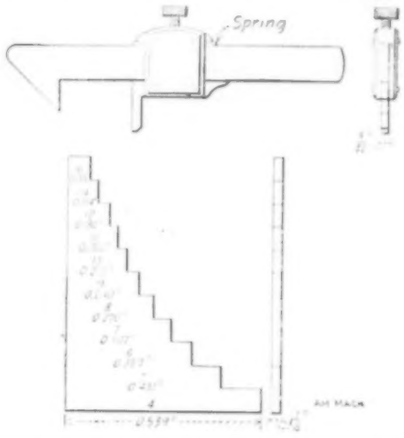
Windsor, Vt. K. H. CRUMRINE.



AN ANGLE-CUTTER GRINDER

An Adjustable Gear Tooth Depth Gage

The linecut shows a gage to scribe the depth of gear teeth on the face of gear blanks. With this adjustable gage only two pieces are necessary. The gage is



ADJUSTABLE GEAR-TOOTH DEPTH GAGE

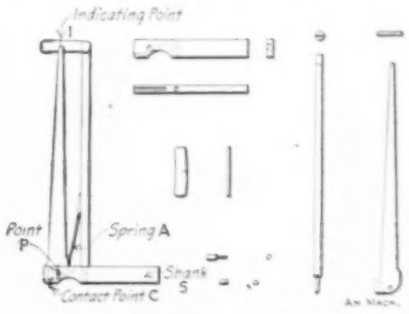
made of 3/32-inch tool steel. The jaws are set the required distance apart by inserting the standard, which consists of a series of steps, the width of each step being equal to the depth of the pitch.

Buffalo, N. Y. C. HARRIS.

Indicating Attachment for B. & S. Hight Gage

The value of the Brown & Sharpe vernier hight gage in laying out work, locating buttons used for boring holes in jigs and testing tools, jigs, fixtures, etc., is recognized by every toolmaker engaged in this class of work.

In the sketch herewith is shown an indicating attachment for use with the hight



AN INDICATING ATTACHMENT

gage where it is desired that the contact be made more sensitive. The shank *S*, fitting into the yoke on the measuring end of the hight gage, is held very rigid when in use.

A is the spring, which, exerting pressure on the rear of the indicating lever *I*, tends to throw the arm forward and bring the contact point *C*, which is inserted in the end of the arm pivoted at *P*, to bear on the work until the lines at the indicating point coincide; thus we are assbured of the same pressure of contact for each reading. The distances measured are read off on the vernier as in ordinary use.

This instrument has given excellent results in one of the large firearm plants in New York.

F. CHAS. SCRIBNER.

Hartford, Conn.

A Fixture for Shaping Large Radii

Fig. 1 shows a fixture I designed for planing large segments. The radii of these segments were from 2.5 to 5 meters (97.5 to 195 inches).

Formerly this work was done on a large facing lathe, the tool holder being held in the faceplate and the work placed in a pit. This method was very slow, in fact it took three times longer to do the work by the old method than it does with our present one.

The link *A* was pivoted at the top at *E* and at the bottom at *B* on the saddle of the shaper

As the shaper was fed bodily across the floor plates *D* parallel with the work *C* the saddle was raised on each side of the center line and the tool cut the desired arc. A double-tool block was used so as to cut on the return stroke.

Fig. 2 shows the outfit diagrammatically.

A. BACHERT.
Works engineer.

Haspe, Germany.

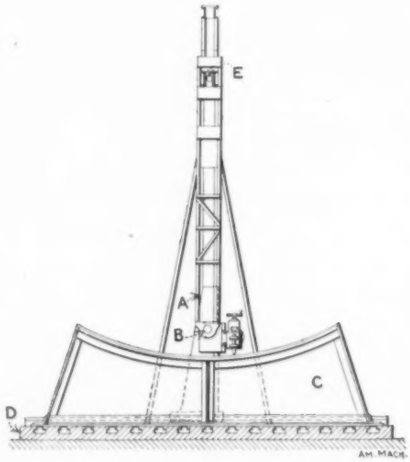


FIG. 2. THE FIXTURE

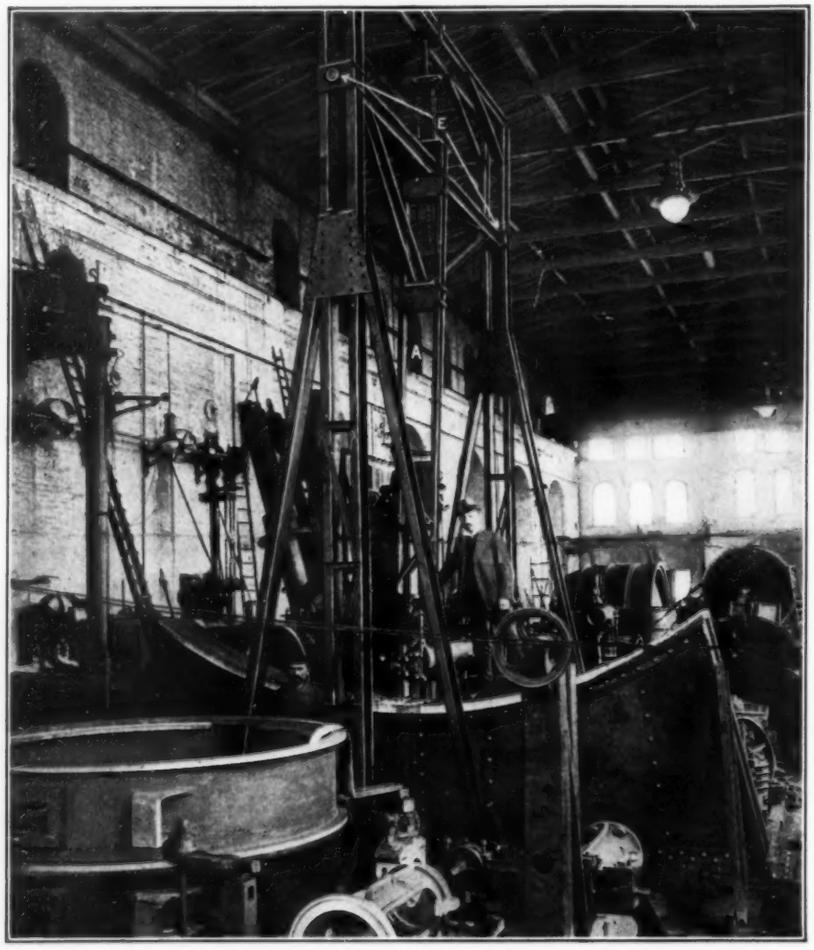


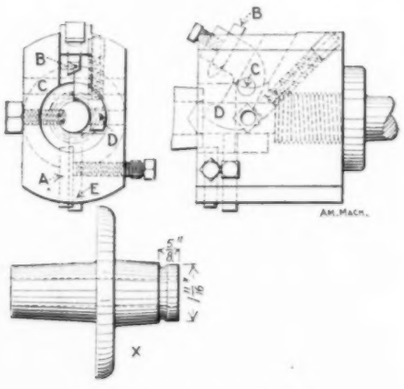
FIG. 1. SHAPING THE SEGMENTS

Turning on the Driller

Having to get out a lot of castings, as shown at *X* is the line cut, and only a lathe or driller at my command, I designed this tool and chose the driller because it gave me greater production.

The construction of the tool is, I think, very plain from the drawing.

Its action is as follows: The pilot enters the cored hole in the center of the casting. The tool *A* then turns the casting to the proper diameter. During the downward movement of the driller spindle the tool *B*, which is pivoted at *C*, is rotated around *C* by making contact with the face of the casting and point *D*. When the tool has advanced to the proper point, the tool *B* is forced in position to properly turn the recess in the casting. At this point the tool *E* faces off the top of the casting.



THE WORK AND THE TOOL

By following the action of these various elements, it will be seen the tool makes its own stop and cannot be crowded lower than the predetermined depth necessary to hold the diameters.

JOSEPH F. PFLUM.

Canton, Illinois.

Comparatively few American manufacturers light their cigars with $20 bills. It is too slow a method of burning money. As they prefer to burn it by shovelfuls, they burn it in the boiler room, said Arthur D. Little in a recent lecture reviewing the "Earning Power of Chemistry." They forget that in ostensibly buying coal they are really buying heat and they pay good money for slate and sulphur balls with no knowledge of the actual number of B.t.u. they are receiving for a dollar. Or they may be like the Irish coal dealer who was asked how many B.t.u. his coal contained. "Divil a wan," he replied, and many people equally ignorant depend upon a trade name, ignoring the fact that coals from different mines in the same district vary greatly, as does also coal from the same mine. Moreover coal, like some other things, is not always true to name.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Round Nose Roughing Tool

We have read with considerable interest the article written by J. T. Towlson, of London, England, on a round-nose roughing tool, illustrated on page 512. From this article it is very evident that the cut and description which you used to describe our new round-nose roughing tool were not sufficient to illustrate the many features, we will say different from the old form of wedge tool which Mr. Towlson describes. The tool which he has shown and which he made in 1897 is very similar to a number of tools that we have run across in our experience. One

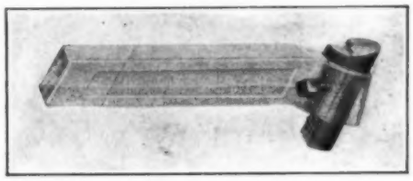


FIG. 1. ROUND NOSE ROUGHING TOOL

which the writer has in hand now was given to us by a Philadelphia friend, and we have frequently seen others made on this same principle.

Mr. Towlson's tool, however, has none of the features of our "One Grind" tool. From his article, he evidently thinks that the cutter and dog are made in the form of a wedge similar to his and held by a setscrew in the back. From the accompanying transparent view, we believe that the principle of our tool will be more easily understood. Our cutter is held with the teeth cut in the back, these interlocking with the teeth in the front of the dog. These together are supported by a heavy flange on top of the dog and the setscrew

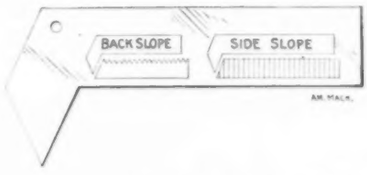


FIG. 2. TOOL GRINDING TEMPLET

in the back is used merely to hold the cutter and dog up to the front of the holder and not as a means of support; in this way we get perfect contact, which is of assistance in the dissipation of heat.

This tool was designed for us by Carl G. Barth, and Mr. Barth has applied the Taylor cutting contours and angles in the form of a tool holder, at the same time keeping especially in mind supporting the tool with a lathe-tool post very close to the head, making an extremely rigid tool, required especially for high speeds and fast feeds for roughing purposes. As proved by Mr. Taylor these cutting contours and angles are the best for heavy-duty service, and in our tool we have for the first time applied these principles into the form of a tool holder.

Another feature which was not shown by your description is the grinding templet, shown in Fig. 2, by the use of which the mechanic can without guesswork maintain the correct back slope and side rake.

Bridgeport, Conn. T. FISH,
President, Ready Tool Company.

Science versus Personal Bias

Under the above heading, on page 489, L. J. Rodgers describes what I believe to be an imaginary condition of affairs existing in "a number of the best manufacturing shops," which he has recently visited.

Since I also have had the pleasure of visiting some of the best shops as they are now credited, and have in these visits failed to observe and do not now recall any condition which would suggest an existing state of "personal bias" in the operation of any of these shops, I cannot but believe that Mr. Rodgers has seen with an imperfect vision.

That this is true is also evidenced in the allegation that "each manufacturer seems to be trying to prove that the ideal shop should have at least 75 per cent. of its total number of machines of his own particular line."

What freak machine tool is there in existence the manufacture of which could be made commercially profitable in a shop where three-fourths of all the machines in the shop were of the same kind as the machine itself?

Mr. Rodgers says, "machine work is even now an exact science," a bold statement in the face of all the argument recently put forth to the contrary. But let us hope it is his belief that such is the truth which influenced him in giving as "examples of personal bias" in shop management, the cases cited.

Let us look into two other shops where cone pulleys are being machined as explained by Mr. Rodgers, and it is possible that the time on the work by the lathe and grinder, respectively, may be reversed, which could not possibly be attributed to personal bias in this latter case.

The first Pratt & Whitney vertical surface grinder I ever saw was in the shop of a prominent miller manufacturer, where I was *shown its advantages* as applied to certain classes of work.

Shaper manufacturers have allowed halftones to appear in the technical papers and in advertising pamphlets showing the rocker arms and other parts of their shapers being machined on a miller as examples of *rapid milling*. On page 211 there were two halftones showing how a miller manufacturer *planes* eight miller tables at a setting, and planes 12 miller saddles at a setting.

There are milling attachments for planers, slotting attachments for millers, and grinding attachments for lathes, all of which are acknowledgment of the advisability of this method of removing the metal under certain conditions; and these are distinct suggestions to the user to purchase a miller, or slotter, or grinder when the quantity of that class of work justifies it.

Not all shops are so evenly balanced in men and machines as to keep the product flowing through the shop in an even, steady stream, with every machine running and every man in his place day after day. We may sometimes walk in on a well managed shop and find them getting out a lot of work on what appears to be the wrong machine, and thereby reflecting "personal bias," but in reality the work is being done there as an expedient because of a breakdown to the right machine or other cause.

When we consider the wonderful advancements made in machine-tool building during recent years, of the close association of builders and interchange of ideas, and their willingness to have published their methods of manufacture—sometimes to the minutest detail—it hardly reflects any grave state of personal bias existing in the management of such shops.

THE PROBLEM UP TO THE USER

It always has been and ever will be largely up to the user to determine as to the type of machine best suited to our work and the make of machine to which our work is best adapted. We may some-

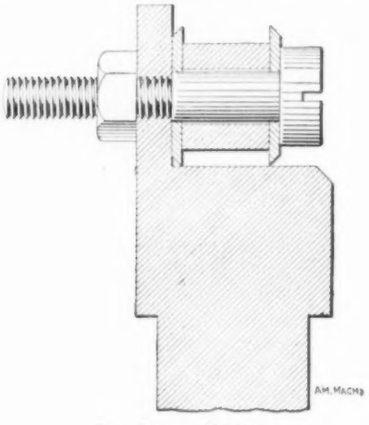
times make an apparent mistake in purchasing, but if we insist that we were inveigled into buying the wrong machine, please do not contend that the builder's ethics have given way to personal bias in the conduct of his business because he recommended the wrong tool, but rather lay it to the fact that we have not yet attained perfection in the matter of proper selection of machine tools, nor to a scientific manipulation of them, strictly speaking, after we have them in our possession.

When machine work shall have been reduced to a science and we have become fully able to appreciate it when we meet it, the machine-tool builders will, no doubt, be found as being among its chief adherents.

Zanesville, O. H. R. GILLIAM.

An Index Plate

The index plate described on page 307, Volume 34, reminds me of an index plate that we made some time ago. A contract had been taken to build a number of machines and the design called for metric threads throughout. Apparently it never occurred to anyone that there



AN INDEX PLATE

would be any difficulty in cutting metric threads, so the discovery that none of the lathes were equipped for this was not made until a considerable amount of work had been turned up ready for threading. As the office had been unduly optimistic as to delivery dates, we were a long way behind, so when the matter was reported a rush order was sent through to turn up and cut a 127-tooth gear for one of the lathes. A blank was soon turned up and we set up a plain miller to cut the gear, but the dividing-head table had skipped 127, so there was another report to the office, coupled with the suggestion that the gear be sent out to be cut, but this would not be tolerated, so I had to get out of the difficulty in some way. We used a lot of ½-inch pitch roller chain for various purposes, and it occurred to me that we could make an index plate of it, which we did as follows: Three pieces of chain totaling 127 links were taken and joined to make a continuous chain, with three special screws such as shown in the cut. A wheel blank was turned, as shown in section, and of such a size that the chain just pressed on nicely, three holes having been drilled in the flange for the three screws, which acted as stops to prevent the chain being pulled around on the blank. This formed the index plate, and a few pieces of scrap made the finger.

The index plate was mounted on the same mandrel as the gear, put between the centers on the milling machine, and the gear cut without trouble, the most awkward part being the fact that the index plate was so large that we had to block up the heads a lot to admit it.

London, England. A. RAYMOND.

Increasing Output of Screw Machines

I was very much interested in reading the article on page 69, by S. N. Bacon, describing the method by which he increased the production of the piece shown in Fig. 1, by 80.5 per cent. over the old method of making this piece. Without criticizing the article in question, I will show another method of making this piece, by which the increased production is 125 per cent. over the original method, and using the same speeds and feeds as shown by Mr. Bacon in his improved method.

Fig. 1 shows the piece with the cutoff and forming tools in position. It will be seen that the forming tool is different from the one used by Mr. Bacon, it being a little wider and having a portion marked *A* about 0.015 larger in diameter than the body of the tool. This takes off the sharp corner and also assists the cutoff tool; although the forming tool is a little wider, the feed is not too great.

With this method, the finished piece is fed through against a stop in the turret, and the first operation is cutting off the piece already formed and bored. The forming tool also commences to form the next piece at the same time as the cutting-off tool commences to sever the finished piece, and continues forming during the cutting off, and also while the ½-inch drill is performing its operation.

The forming tool performs only part of its work during the two operations mentioned above, it then drops back clear while the ¼-inch drill does its work. The forming tool then again comes into operation and finishes forming the piece. The nurling and counterboring are done in the same manner as mentioned in the previous article. The gross production obtained is 300; the net production (10 per cent. less) is 270. If high-speed steel cutoff and forming tools were used a much higher speed and feed could be used, which would greatly increase the production.

Fig. 2 shows another piece in which an alteration in the method of making, combined with the use of high-speed steel for the cutoff and forming tools, was the means of increasing the production 200 per cent.

Formerly this piece was made by using two hollow mills in the turret for rough turning, and a box tool to turn two diam-

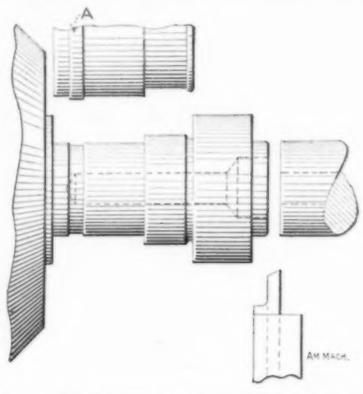


FIG. 1. A SCREW-MACHINE JOB AND THE CROSS-SLIDE TOOLS

eters for finishing. Fig. 2 shows the piece as made by the new method with the tools in position; this is the cutoff and form method. The cutoff tool is fed in part way at 0.0015 feed, then for the finish cutoff and the reduction of the ⅜-inch end a feed of 0.001 is used. At the same time the rear forming tool is in operation under a feed of 0.00075 inch. Then the box tool set for turning two diameters finishes the two sizes with a movement of ½ inch, after which the end

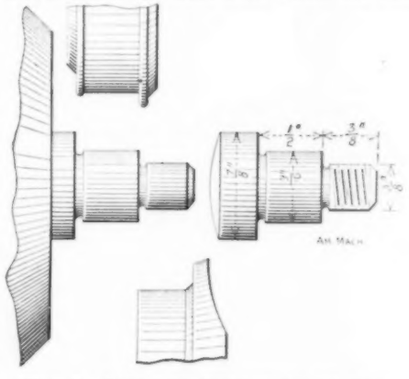


FIG. 2. ANOTHER OPERATION ON THE SCREW MACHINE

is threaded and the stock fed out to a stop in the turret. The net production is 450 as compared with the former production of 150.

No doubt many readers who have to make cams for the Brown & Sharpe auto screw machines, have found a difficulty in cutting them on the miller, when such cams have only a very small rise covering a great number of degrees of the cam's periphery. The set of cams shown in Fig. 3 for making the small screw, also shown in Fig. 3, are typical ones.

The following is a simple method of milling such cams. For calculating the left of the knee, and the indexing of the dividing head use the formula:

$$A \div B \div C = D$$

Where

A = Length or depth to be cut by the tool,

B = Per cent. in hunudredths of lobe of cam,

C = Lift of knee decided upon,

D = Number of divisions for which to select index plate.

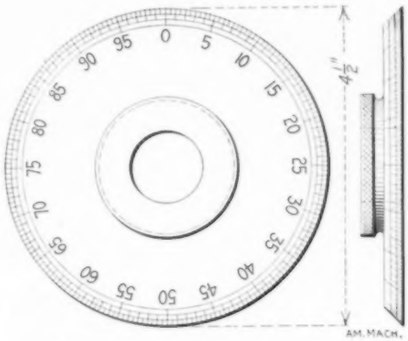


FIG. 3. THE CAM AND THE WORK

As an example we will work out the cams for the small screw shown in Fig. 3,

LIST OF OPERATIONS AND SPEEDS AND FEEDS. NO. 00 MACHINE

Spindle, 675 R.p.m. forward; 1273 R.p.m. backward

High Speed Steel Tools		R.p.m.	R.p.m.	Hundredths of Cam
Size of stock $\frac{7}{32}$ in.		675	1273	
Form 0.049 in. travel at 0.00048 in. feed per revolution and dwell 5 revolutions	overlap		102	60
			5	3
Cut off 0.117 in. travel at 0.00116 in. feed and dwell 5 revolutions			102	60
			5	3
Clearance			10	6
Thread 10 on		10	19	11
Thread 10 off			10	6
Revolve turret			12	7
Feed stock to stop in turret			12	7
Total revolutions			170	100

Gross production, 4500. Net production, 10 per cent. off, 4000. Gears driver, 60. Driven, 48.

From the formula we will first work out the cam for the back slide (forming).

Lift of knee decided upon = 0.0005 inch. From the list of operations $A = 0.049$ inch. $B = 0.6$. Then $A \div B \div C = 0.049 \div 0.6 \div 0.005 = 163$ divisions for which to select index plate. One hundred and sixty-four divisions being the nearest number for direct indexing this is chosen, as the difference may be safely neglected.

This calls for a 41 index plate, and a move of 10 holes for each division. The example now stands; dwell 3/100 of cam, then lift the knee 0.0005 and mill across, then move 10 holes in the index plate and lift the knee 0.0005 and mill across; repeat until the lobe of the cam is finished.

Working out the front slide cam for the cutoff tool, we will make $C = 0.001$ as this cam has a much greater depth to cut it will stand a greater lift of the knee for each move of the indexing head.

Then $A \div B \div C = 0.117 \div 0.6 \div 0.001 = 195$ divisions. This calls for a 39 index, and a move of 8 holes = 1 division Dwell 3/100, then lift the knee 0.001 inch and mill across, repeat until the lobe of the cam is finished.

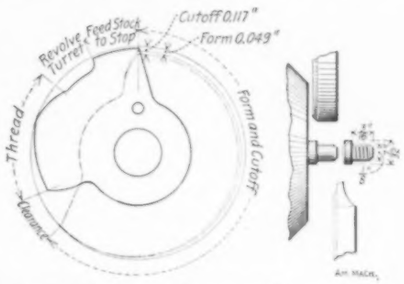


FIG. 4. DIAL FOR CUTTING CAMS IN THE MILLER

The greater the lift on the lobe of the cam, the greater may C in the formula be made. The small flats made by the milling cutter can easily be drawfiled off, leaving an almost perfect curve on the lobe of the cam.

In using this method of milling cams it will be found a great convenience to make an index dial with 200 divisions as shown in Fig. 4 by which a lift of 0.00025 inch can be given to the miller knee.

A. BUTTERWORTH.

Rochdale, England.

Too Much Light Injures Eyes

There has been a number of articles lately dealing with the important subject of lighting machine shops, foundries and drafting rooms. Being a draftsman, perhaps the problem as applied to drafting rooms has interested me more particularly. The problem of satisfactorily lighting a drafting room appears to me much more difficult of solution than the lighting of a machine shop or foundry.

I am glad to see that most of the writers recognize that an excess of light may be as injurious to the eyes as too little. Excess of light, if the term may be allowed, does little harm in a foundry or machine shop, where, as the articles worked with are frequently dark in color, they do not reflect light into the eyes as a large sheet of white paper does, and where the strain on the eyes is not nearly so severe as in drafting.

Some firms solve the drafting-room lighting problem by putting windows in every available inch of wall space, and if the building allows it, by skylights in the roof as well. The room is certainly well lighted, but is it lighted in a manner compatible with the comfort of the draftsman? Anyone who has worked directly under a skylight will say that he is more dazzled than helped by the light from that skylight. The light falls directly downward, and the board is so inclined that the paper reflects it directly into the draftsman's eyes.

I never had the least trouble with my eyes until I started working on the board. I was then about 22. As soon as I began on the board I found trouble. My eyes ached and burned in the most painful manner. The drafting room was one of the most uptodate in this country, the ceiling being studded with skylights and most of the available wall space occupied by windows. If I had been doing any ordinary shop work the light would have had no effect on me, but it was the intensity of the glare on the white paper that made the difference. At that time I did not know the trouble was mostly due to the fact that light from the skylight directly above was reflected straight into my eyes.

I left the uptodate shop with its skylights, side lights, end lights, and glass everywhere, and after one or two moves, found what I was looking for. It was a shop that made not the slightest pretense to being uptodate. Its drafting room, which was not at all large, was long and narrow, and had windows only along one side. The tables were arranged so that the light came from the left-hand side.

As soon as I started there, I noticed a change. There was no longer any dazzling effect on the paper. My eyes did not trouble me, and the irritation from my previous work speedily vanished. Neither did I have any return of eye trouble, and the few years spent at the uptodate shop do not appear to have left any permanent ill effect.

All my trouble, which had been diagnosed by oculists under various names, had been due to a too intense light falling on the board at the wrong angle.

Of course, there are many whose eyes are not so sensitive. They are fortunate. But there must be quite a number who have experienced the effects I have described, in a more or less acute form.

It will also be frequently noticed that the electric lamp or gas light is placed directly over the board, instead of to one side, preferably the left. This again produces the injurious dazzling effect.

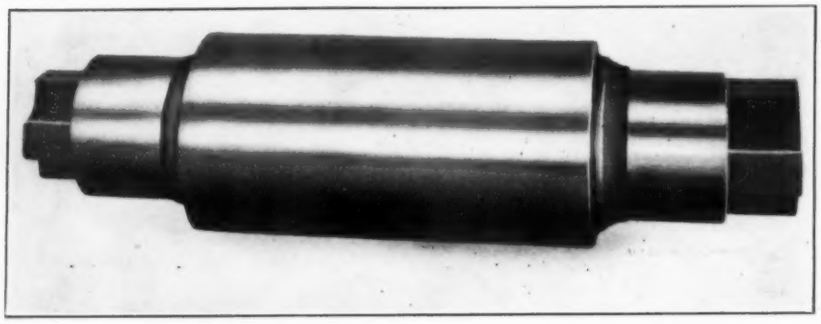
Coventry, England. P. S. CHENEY.

Grinding Chilled Cast Iron Rolls

I have read with interest, on page 171 an article on grinding chilled cast iron, by W. G. Nevin, and as I have operated grinding machines with moving work table, as well as with moving wheel carriage, I believe when he says that when the wheel moves, and the work does *not* have a longitudinal movement, it is the best proposition; not only because I think the principle is correct but the operator can grind with more ease and skill on a grinding machine with a moving wheel carriage, because the wheel feed is on the

same side of the work as the wheel and it enables him to see how close the wheel is to the work when starting a cut.

Mr. Nevin states that an excellent wheel for chilled cast iron is a "46 K" corundum, but does not say how good it is or what he has accomplished with it, and it seems to me that if some record of what has been done with this wheel had accompanied his article, it would have been valuable data for comparative work.



GRINDING CHILLED CAST-IRON ROLLS

The halftone shows a chilled cast-iron roll 20 3/16 inches diameter by 28 inches long which I ground on a Landis 20x96-inch roll grinder, removing ¼ inch from the diameter of the body only. Surface speed of roll, roughing, 52½ feet; finishing 52½ feet; traverse of wheel for each revolution of the work, 7/8 inch; wheel feed at each reversal, 0.006 inch for roughing; 0.001 inch for finishing. This roll was ground with a 22 3/16-inch carborundum wheel having a 2x8-inch hole, 403 P., Bond O. F., running at 925 revolutions, 5472 surface feet, and it was reduced in diameter 1/32 inch, which is a cost of 90 cents. This wheel wore just fast enough to keep itself sharp and, for roughing, was only dressed once with the diamond. Time for grinding the roll to a smooth finish, good enough for hot rolling, 4 hours; total cubic inches removed, 221; cubic inches removed per minute to finished surface, 0.92 inch. The motor used on this work was a variable speed 25 horsepower. Average horsepower consumed, 21.

I do not believe there is much, if any, difference in wheel contact when it comes to producing a high finish. For example, if it requires 15 minutes to grind a high polish on a piece of work 1 inch in diameter, to grind a piece of work 12 inches in diameter, the same length, should take twelve times as long, or just 3 hours, using, of course, the same peripheral speed. While I have no data on this, it seems reasonable that if a large piece of work is to be given the same bright finish as a smaller one, the amount of times the wheel passes over one point must be taken into consideration.

J. H. HOLLINGER.

Waynesboro, Penn.

How Machines Are Designed

Entropy's article on how machines are designed, page 494, was read with considerable interest. It seems to me that each machine should be designed by one man, since no doubt when a new machine is needed the man is called upon who is most able, in the opinion of the one wanting the machine, to get something that is wanted.

Now if the man called upon to furnish this new design has to open a book and first read the rules on how to start, it might be better if some other man were called upon to furnish the design. This, however, is only the writer's conjecture, and each designer might have a conjecture of his own—it is a part of each designer. And it indeed would be interesting, as Entropy says, to see the workings of the brain of each designer, since each has his own peculiar way to get at it. No doubt the average designer does most of his designing where everything is dark and everybody is asleep in the immediate neighborhood, and there he gets to thinking how his pet will look when it is finished, and he thinks so much about it that he can actually see it in the dark. This is no pipe dream. I believe it is nine out of ten times the case, however. I am not speaking of the designer (?) who plagiarizes everything but about three or four bolts.

When the general appearance is fixed in the designer's mind and the object to be attained has become second nature, it is fairly easy to place a general outline on a blackboard or on paper, and to add on here and take a little off there, and right here I wish to say that very frequently it has to be taken away entirely, because the general outline does not look as though it might be taken for that which it was intended, especially when the designer lacks courage, or when the designer is an employee and the boss comes around and says it is too radical and that such a monstrosity could not be given away, much less sold at a profit.

Well, when he has the general design on the board, the next question that suggests itself ought to be: Is there anything about this preliminary outline that could be changed so that it would make a large and expensive equipment unnecessary, and are the tools at hand to produce this machine at a competitive price. You know how the boss kicks on this, even if the design is excellent. Besides don't forget that it has to be made in sand first.

When all of these points have been agreed upon and the machine stands there upon the blackboard or paper made to an approximate scale, then is the time, if at all, to bring on another designer, to see that everything in a general way is about from three to ten times stronger than it needs to be, because the foundry does not always get the cores where they should be, or the cope on the drag just perfect. Neither will the tool that will be used in the machine be ground according to Hoyle, and once in a while the machine will become stalled so suddenly that it will make your hair stand up pompadour.

Now in a planer, for example, if the bed, housings and cross rail are made strong enough to stand this treatment, then this part of the machine will be O. K., and to arrive at this point it might be well to ascertain the flywheel effect or momentum stored up in your driving pulley, or if a direct-connected motor drive, what the momentum is in your armature, and, believe me, it is no small affair when you undertake to stop it suddenly at the end of a speed-reducing train of gears, especially where no outlet has been provided. This takes us back a step and the question arises: How heavy must an armature or a drive pulley be through which the necessary power can be delivered to the cutting tool at a given speed, or to remove the desired amount of stock per minute? When he has passed this point in designing his machine, then his knowledge of known and well tried mechanical movements begins to stand by him directly in proportion to the amount he possesses. This knowledge cannot be obtained in cheap novels or at the drug store on the corner, and I might mention about 17 other places.

In the final windup, remember that man has only two hands with which to operate a machine, though once in a while, if the handle to be reached is not too high above your head, a foot can be brought into use, but few machinists are acrobats; hence it is safer to adapt the operation of a machine to two hands.

Invention often enters into machine design, but its application is such an unknown quantity that it appears as though it would be out of place if it were discussed here machine design, viewed from the same point that you would an exact science, will probably always remain a joke, but considerable can be done toward easing things for one of little experience.

J. G. DORNBIRER.

Cleveland Planer Works, Cleveland, O.

Shop Floors and Their Materials*

By Leonard C. Wason†

A discussion of the factors to be considered in choosing a suitable material for a shop floor.

The characteristics of the different types of floors.

*Read at the October New York meeting of the American Society of Mechanical Engineers.

†President, Aberthaw Construction Company, Boston.

No floor surface is perfect from every point of view. The question of what floor to adopt for a shop is therefore always a choice between different combinations of good and less good qualities. While the factor of cost is apt to be considered the dominating one, there are many situations in which cheapness is not the most important item in the choice of a floor; or to put the matter a little differently, it is sometimes economy to discard the floor that is the cheapest in first cost for a different floor of higher cost that will justify this higher cost because of its greater suitability to the particular kind of service required of it. Therefore, although I have been asked to speak particularly about granolithic floor surfaces for shops, I am not in the attitude of advising a granolithic floor for any and every service under any and all conditions. The granolithic surface has good qualities of great importance, and I shall give these qualities due weight. But I shall also point out some of the circumstances under which it may be better in particular cases to put in wooden floors.

Comparison of Granolithic and Wooden Floors

In first cost the granolithic floor surface has the advantage over a wooden floor, the cost of such a surface laid in the best manner being about equal to the cost of seven-eighths maple flooring delivered at the work. Besides this advantage in cost, the granolithic surface is fireproof and waterproof, and will not decay or disintegrate under washing with water, which is one of the weak points of the wooden floor.

There are other considerations involved in a decision between granolithic and wooden floors, concerning which it is unsafe to be very dogmatic without first defining very precisely the conditions of each particular case. Taking first such a matter as the wear of these two types of floor, it is easy to see that a wooden floor is more easily repaired than a granolithic surface, and that repairs to a wooden floor can bring the floor to its original maximum efficiency. A granolithic surface also can be repaired so that the new patches will be quite as good as the original surface, but the time and care required is much greater than with a wooden floor.

In repairing a granolithic surface it is necessary for best results to cut out the broken or defective portion down to the slab, leaving the cut with vertical edges. Next, the slab must be cut with a sand blast or acid until the aggregate stands out sufficiently to give a good bond for the new surface. Then the slab, and edges of the cut, having first been well wetted, must be grouted with neat cement mortar, on which the new finish is laid before the grout has set. Finally, the patch must be kept wet, and protected from use for at least a week. It is rarely possible to satisfy all these necessary conditions, and it is therefore true that under average practical conditions, the repaired portions of granolithic floors are inferior to the original surface in wearing quality.

The Question of Workmanship

In this contrast between wooden and granolithic floors we have to deal with the question of workmanship. With a maple top floor the difference in wearing quality between a floor laid by a first-class carpenter and the floor laid by a merely average carpenter, is comparatively slight; but with the granolithic finish, ignorant or hasty work is disastrous almost from the outset. The granolithic finish, to give good service, must be laid according to the right theory, and every step in the workmanship must be first class. It is not at all difficult to get a first-class granolithic surface if one starts out with a determination to have it. Good work costs very little more than poor work. It must be admitted, however, that a great many granolithic floors have been unsatisfactory. Poor workmanship and wrongly chosen materials are the reasons.

Effects of Heat Conductivity

Among objections which have been raised to the granolithic surface, one of the most prominent is the bad effect of the concrete floor upon the health and comfort of the operatives who stand upon it. There seems to be little doubt that long standing in one position on a concrete floor is not good for the operative. The reason for such ill effects as occur is not the excessive hardness of the concrete floor, as is so generally supposed, but its great heat conductivtiy. Wood is a poor conductor, a poor radiator, and therefore in general a pretty effective insulator. But when an operative stands for hours on a concrete floor, the heat of his body is conducted from his boot soles into the concrete rather rapidly.

In consequence of this drawing away of the body heat, feet and legs become more or less chilled, the circulation in the legs is slackened, and pressure on the skin of the feet, coupled with this sluggishness of circulation, due to the loss of heat, may easily give rise to sore feet and to the various pains which are commonly classed under the head of "rheumatism." That these bad effects do occur has conclusively appeared in investigation of the whole question made by the Aberthaw Construction Company about a year ago. For operatives who are moving about while at their work, or who wear thick-soled boots, this excessive extraction of the body heat by the concrete floor is a negligible matter. For men working steadily at the machines in one position, some insulation is required. It is the practice in many machine shops to give the men foot boards or gratings of wood on which to stand. These do away altogether with any ill effects from the concrete floor.

Durability under Rough Usage

Granolithic floors have been attacked as not sufficiently durable under the rough usage of machine shops and foundries. Here again we have to take into consideration the all important items of materials, workmanship, and theory of construction. Nothing but the hardest natural stone in the way of a masonry floor can long withstand the wear of heavy trucking. The usual form of truck is provided with small diameter wheels having a flat tread and sharp edges, and such wheels with the tilting or slewing of trucks that is always in evidence in turning corners, will gouge and dig into any kind of floor.

But the granolithic finish can be so made with such a high percentage of tough, elastic aggregate that the wear of trucking is borne almost exclusively by the aggregate itself. Nothing but steel and granite can outwear such a floor. It is the part of wisdom in laying granolithic floors over which there is a heavy truck traffic along certain lines, to provide steel plates or gratings properly set in the concrete to form lanes or tracks for the heavy trucks.

Choice Affected by the Nature of the Tools

The nature of the tools, processes and products in a given shop bear on the decision between granolithic and wooden floors. An edged tool dropped edge down on a granolithic floor would be damaged by the impact, while the same tool dropped edge down on a wooden floor

would dig into the wood and probably suffer no damage. Also, a manufactured product consisting of delicate metal pieces would be much more damaged by falling on a cement floor than on a wooden floor. Still further, the dust produced by the wear of some granolithic surfaces has proved harmful to delicate machinery in some shops. The wooden floor does not of itself produce a dust capable of any visible action as an abrasive. It is possible, however, by gluing battleship linoleum to a concrete floor to get many of the advantages of a wooden surface.

Tools and small manufactured articles are as little likely to break by falling on a linoleum surface as upon wood. The linoleum is without the innumerable cracks of the wooden floor and therefore is much more easily kept perfectly free from dust. Linoleum is also an efficient insulation against loss of the body heat to the concrete floor.

Granolithic Floors

High resistance to wear of every sort and practically complete dustlessness, that is to say, freedom from the production of abrasive dust, can be secured in a granolithic surface properly made. It is always better that a granolithic finish should be laid on the floor slab while the latter is still green. A better bond between the finish and the slab can be obtained in this way than is possible after the slab has fully set.

Unfortunately, the conditions governing the erection of concrete buildings usually put off the laying of the floor finish until all the rest of the building is practically completed, and this involves the need of using great care in cleaning and roughening the slab surface so that the granolithic finish laid upon it will get the best possible bond with the slab. Ordinarily the finish need not be more than three-quarters of an inch thick. Both for wearing capacity and for the avoidance of dust through abrasion of the concrete, the granolithic finish should contain the highest possible proportion of tough stone aggregate.

For the most durable and most nearly dustless floor my rule is this: First, it is better to use no sand; sand grains are brittle, are early broken by the abrasion of feet, and cause dustiness. For an aggregate use a stone suitable for macadam road, taking the sizes that pass through a half-inch round mesh screen, and nothing smaller than that passed by a 20-mesh screen. Mix the concrete dry, of the consistency used in making blocks, so that considerable tamping will be required to bring to the surface enough water for troweling. Finally, do the troweling before the mortar sets. It is practicable in this way to get a surface that is 90 per cent. hard stone; the mortar, of course, wears more quickly, but its small area makes results of this wear unobjectionable.

Prolonged troweling of a wet mixture brings to the top the "laitance" of the concrete, which is the part incapable of a true set. A top layer of laitance is therefore porous and wears down quickly. Even the fine particles of good cement should not be brought to the top, for they form a layer which is weakly bonded to the rest of the concrete, and which wears away quickly, appearing in the air as dust.

Factory Development and Arrangement*

By L. D. Burlingame†

I purpose to discuss the plan by which parts of a machine are manufactured as separate units, complete in themselves, the department where such units are built being equipped, at least to a large extent, with the different kinds of machines needed to perform the various operations required in their manufacture. This may be named the "Group-Department Plan."

In taking up this discussion two questions may be raised: First, under what conditions is it of advantage to build parts of machines as distinct units? Second, how shall the machinery in the shop be grouped to most economically manufacture them?

Reasons for Dividing a Machine into Separate Units

Taking up the first question, some of the reasons for dividing a machine into separate units to aid in manufacture are:

(A) Where the nature of the unit is such that it can be manufactured to better advantage in a particular department equipped for that class of work.

(B) Where it is used for more than one machine and can be manufactured for stock in larger quantities than any of the machines on which it is used.

(C) Where there is a constant call for such a part to be used either for repairs or on special machines.

(D) Where the work is of such a nature that a sufficient saving can be effected to warrant manufacturing in larger quantities than in the case of the machine itself.

The system of manufacturing parts of machines as independent units has been in use by the company with which I am connected, the Brown & Sharpe Manufacturing Company, for many years having been the subject of patents owned by that company, but now expired. This principle of manufacture is applied to almost all lines of machines made by them. In investigating the systems in use by some progressive shops abroad recently I found it to be the almost universal practice to use some system of unit stock parts.

*Read at the October New York meeting of the American Society of Mechanical Engineers.

†Chief draftsman, Brown & Sharpe Manufacturing Company.

The Grouping Explained

As an illustration of the kind of grouping to which I refer the spiral head of a milling machine might be mentioned. This forms a self-contained unit which can be manufactured to advantage in a separate department under this plan, a unit for the manufacture of which the foreman can be held responsible as to cost, time of completion, accuracy and finish. The cost of such a unit can be known more exactly by this method than in the case where it is not separated from the complete machine, for by building it as a separate unit it is possible to know more exactly just where there is a gain in manufacturing and where there is a falling behind.

By the system here advocated all stages of the work for a complete unit of manufacture can be under the eye of a responsible man who can put all his experience and enthusiasm into reducing the cost, raising the standard of workmanship and seeing that the work is completed at the time needed. This method of manufacture also gives a great degree of flexibility, allowing for readily transferring the work or any part of it from one department to another.

A shop manufacturing a great variety of tools or machines and organized on this system may not only have all the advantages of one confined to a single product, including thorough attention to details and concentration on perfecting a given line of manufacture, but in addi- there are special advantages making it possible to do work better and more economically by having men trained as specialists for each particular line of work and it is also possible to have expensive special machines and equipment, the cost of which can be warranted only in a large shop.

Arrangement Not Necessarily Dependent on Size of Shop

The question of how the machines shall be arranged is not necessarily dependent on the size of the shop. The large shop may be arranged so as to be like a number of small shops but under one management.

When an important order is to be rushed through, this method of manufacture has advantages over a method where each operation is performed in a different department, for the whole job can in the former case be under the eye and control of one foreman. Also by knowing all the ins and outs of the manufacture suggestions for improvements and improved methods of manufacture are more likely to be made and can be more intelligently made.

The Limitations of the System

This brings us to the second consideration as to how far a department should

(*Continued on page* 809)

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OUTLINE OF TOPICS, PAGE 129

American Machinist

Modern Methods and the Small Shop

It seems certain that the next few years will witness still further advances in the organization and administration of industrial enterprises, no matter who is entitled to the credit for these new methods or by what names they may be called. Many of the modern methods and principles which have been so fully dispensed of late have been in operation in some of the larger plants for some time; and it will not be long before their possibilities and limitations, and hence the basis of their successful adoption, will be more clearly apparent. So far, the greater part of the development of these methods has been done in large or at least fair-sized organizations. It is natural that this should be so. The large organization beside its greater financial ability is usually departmentized; a feature which, in general, facilitates the introduction of new ideas. It is also easier to apply successfully these new methods to work which is large, either in size or volume, than to smaller quantities and sizes which constitute the business of the small institution. It is also undoubtedly true that the application of many of these methods to the problems of the small shop has not, as yet, been made very clear, and no doubt many small factories have been frightened by the masses of vague literature, the enormous detail which larger institutions have undertaken, and the high sounding titles which have been given to shop improvement work.

Small shops and factories will do well, however, to look into all new ideas carefully. The larger factories have already driven many small shops out of business, or relegated them to the position of repair shops. This is largely because of inherent advantages which come with manufacturing in quantity, but partly also because the larger institutions are, as a rule, more progressive. A casual visit to the shops of any city will convince one of the general truth of this statement.

On the other hand the small shop or factory has certain advantages over its larger neighbor, where production in small or limited quantities is concerned, and shops organized and equipped for mass production cannot, as a rule, compete against smaller establishments on small quantities. It is only in mass production that the American manufacturer has outstripped foreign competitors. No doubt our whole manufacturing system would be strengthened by more small and medium-sized factories which could successfully compete on small quantities. More small factories are also desirable for sociological reasons and would benefit the workers, both employer and employee.

It is to be hoped that managers of small and medium factories will see to it that their large neighbors are not the only ones to profit by these new, yet old methods, thereby increasing their present advantage. As the editorial from the *Saturday Evening Post* quoted on page 445 has so well expressed it, "scientific management is simply a critical attitude toward the work." The manager of the smallest enterprise who really gets this attitude will find no trouble in applying any of these new ideas which may be applicable to his problem.

More efficient methods and the checking of waste are just as much a part of good management in the small enterprise as in the larger; the questions involved in obtaining a permanent supply of good skilled labor is of far greater importance to the small shop than to the larger one, since its success is dependent upon a relatively larger proportion of skilled help. It is greatly to be hoped that the small shop and factory will draw even more help and inspiration from this movement than the larger, for it may be the means of giving them a new lease of life.

Good Lighting an Important Factor in Efficiency

Our mail recently has contained many expressions of appreciation of the articles on shop lighting by C. E. Clewell. These indicate an awakening to the importance of a phase of the efficiency movement that hitherto has been rather underestimated. Illumination as a well defined branch of engineering is only a few years old; its application in the machine shop is comparatively recent. However, such work as Mr. Clewell and other illuminating engineers are doing constitutes a missionary movement that has already begun to show excellent results.

By way of demonstrating simply and conclusively that good light pays, Mr. Clewell has stated the following hypothetical case: The annual operation and maintenance cost for a typical factory bay may be taken at $50. Such a bay will accommodate, say, five workmen. If the wages of these men equal, say, 25 cents an hour, the gross wages of the five men per annum may equal $3500; the overhead expense may bring the gross cost of their labor to $5000 to $7000. In such a case the lighting will cost 0.7 to 1 per cent. of the wages, or the equivalent of less than four to six minutes a day. Poor lighting will presumably cost at least one-half of this amount, or the equivalent of two to three minutes a day. If, therefore, good light enables a man to do better work to the extent of two or three minutes a day, the installation of good lighting instead of poor will pay for itself.

Although it is hard to gage accurately the better results effected by a good lighting installation, on account of the many other variable factors that enter into the consideration of any particular case, still we expect to present in one of our coming issues some of Mr. Clewell's observations on actual increases in operating efficiencies due to improvements in lighting.

New Site for Massachusetts Institute of Technology

A decision has at length been reached in regard to the new site for the Massachusetts Institute of Technology. Some 50 acres have been, or are to be, purchased on the Cambridge bank of the Charles river facing the new basin. A splendid opportunity is thus presented to build a model group of college buildings, for the land is level and there is a magnificent stretch of a third of a mile of water front.

Thus Cambridge is to have another large educational institution. This at once brings to mind the attempt made a few years ago to combine the Institute with the Lawrence Scientific School of Harvard, and have the combined institution come into possession of the enormous sum of money left by Gordon Mackay. It still seems as if sentiment played too great a part in influencing the decision to keep the schools separate. The prestige coming from a single great technical institution in a certain locality, economical management, the gathering together of a single great teaching staff; these and other important reasons seem sufficient to have brought about union. As it now is, there are to be two great scientific schools in the city of Cambridge and within less than two miles of each other.

New Publication

SELBSTKOSTENBERECHNUNG IM MASCHINENBAU. By Dr. ing. Georg Schlesinger. One hundred and seventy 9x12-inch pages; 4 illustrations; 106 forms; indexed. Julius Springer, Berlin. Price, 10 marks.

Reviewed by Dr. Karl Georg Frank.

Glancing hastily over this treatise one would undoubtedly receive the impression that it contains little more than a series of forms, tables and tabulated data. A careful study of the work, however, reveals an unexpected amount of very valuable information not only confined to subjects indicated by the title but also extended over shop management, as well as embodying office details and management. Very valuable facts and information are called to the reader's attention in a concise and impressive manner, often as a mere remark, giving valuable hints for one looking for such data in a book of this character.

One of the most valuable features of this work is to be found in the fact that the forms and tables given are deduced from actual practical experience and as mentioned in the preface all the material for the forms and tables has been secured by the author from a large number of the foremost German manufacturers whose reputation for the quality of their products and the organization of their factories is of the highest.

The data as given were primarily intended to cover practice in machine shops, but a similar industrial establishment can readily adopt them to their special requirements with slight modifications and can also derive much benefit from a study of the underlying principles involved. Despite the brevity of the accompanying text the author treats his subject in a thorough and systematic manner.

Chapter 1 treats of the recording of incoming orders and indicates how the various forms have been prepared to cover the ordering of the material from the stock room. Chapter 2 is particularly devoted to the consideration of the stock room, special attention is given to the "Stueckliste," which means the numeration of all the individual parts indicated in the drawings and the necessity for such a numeration is clearly indicated and should be carried out with great care.

Chapter 4 is given over to the drawings and sketches in detail; chapter 5 exhaustively treats of the proper accounting of salaries and wages and chapter 6 indicates the organization of the stock room in an exhaustive and thorough manner, showing the method of ordering material, testing, distribution and superintendence.

Chapter 7 is devote entirely to stock on hand.

Chapter 8 treats of the organization and proper accounting of estimated costs in a more general manner.

In much the same manner various other ways and means for calculating shop expenses of all forms are spread before the reader. The second part of the book, from page 122 to 166, goes over practically the same ground as applied by the Prussian government to its shops for the repair of their locomotives.

Anyone interested in questions pertaining to the calculation of estimated costs or to the organization of factories and offices cannot fail to appreciate the valuable information given in this work, particularly as the author is one of the highest authorities on this subject and has endeavored to give in comparatively few pages a comprehensive account of what actually has been accomplished in Germany in these lines and at the same time adding his valuable personal suggestions which cannot fail to be appreciated by the technical instructor as well as the practical engineer and organizer.

The above brief review of the contents of the work hardly does justice to its intrinsic value as is hardly possible without reproducing some of the tables and data. The prints and drawings are most excellent and come fully up to the standard of the well known publishing house of Julius Springer in Berlin. It is to be hoped that the book will receive the support and appreciation it deserves at the hands of American readers.

Personals

C. E. Pettee, works manager of the Herman Pneumatic Machine Company, Zelienople, Penn., for the past three years, has recently resigned.

H. V. Coes, who has been acting as consulting mechanical engineer in Chicago, has been appointed manager of the Chicago office of Lockwood, Greene & Company.

Karl O. Truell, formerly engineer of the Colloseus Cement Company, New York City, has become superintendent of the Sydney Cement Company, Sydney, N. S., Canada.

R. A. Wilson, until recently gas expert with the Snow Steam Pump Works, Buffalo, N. Y., has accepted a similar position with the Carnegie Steel Company, Youngstown, Ohio.

W. H. Trask, Jr., until recently connected with the Denver Engineering Works Company, has become engineer of the United Hydro Electric Company, Idaho Springs, Col.

Joseph E. Aue, for some time past connected with the Snow Steam Pump Works, has become chief engineer of the gas and oil engine department, De La Vergne Machine Company, New York City.

William Robertson, formerly of Robertson Manufacturing Company, Buffalo, and recently manager of the machine-tool department of the Frontier Iron Works, Buffalo, N. Y., has been made general sales manager of the latter company.

W. H. Smead, who has been manager of the heating department, General Fire Extinguisher Company, Warren, Ohio, has been appointed superintendent of the heating and equipment department of the Samuel Austin & Son Company, Cleveland, O.

Charles U. Carpenter, formerly president of the Herring-Hall-Marvin Safe Company, Hamilton, Ohio, has been elected president of the Fireproof Furniture and Construction Company, Miamisburg, Ohio. Mr. Carpenter has also been elected vice-president of the Republic Motor Car Company, Hamilton, Ohio.

Karl Fichtel

On September 8 the well known Bavarian manufacturer, Kommerzienrat Karl Fichtel, partner in the Schweinfurter Precision Ball Bearing factory, Fichtel and Sachs, died at Schweinfurt, Germany. Karl Fichtel was born as a son of a manufacturer in Schweinfurt. When a young man he traveled and lived abroad ten years and made various extensive journeys, among them one around the world, in order to gather information and experience. In 1904 he served as representative of the Commission of the Hungarian Department of the Antwerp World's Fair. There he met the director of the German Cast Steel and Machine Factory Company, Höpflinger, and the future business connection of the two men was of importance to the development of their firm. In 1909 Fichtel was given the honor of a Royal Bavarian Kommerzienrat. He was also a common councilman of Schweinfurt, member of the Chamber of Commerce at that place and representative member of the Chambers of Commerce of Aschaffenburg and Unterfranken.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Heavy Type Radial Driller

The Prentice Brothers Company, of Worcester, Mass., has brought out a new radial driller. The range of the machine is wide, as it will drill a quarter-inch hole or drive an eight-inch pipe tap.

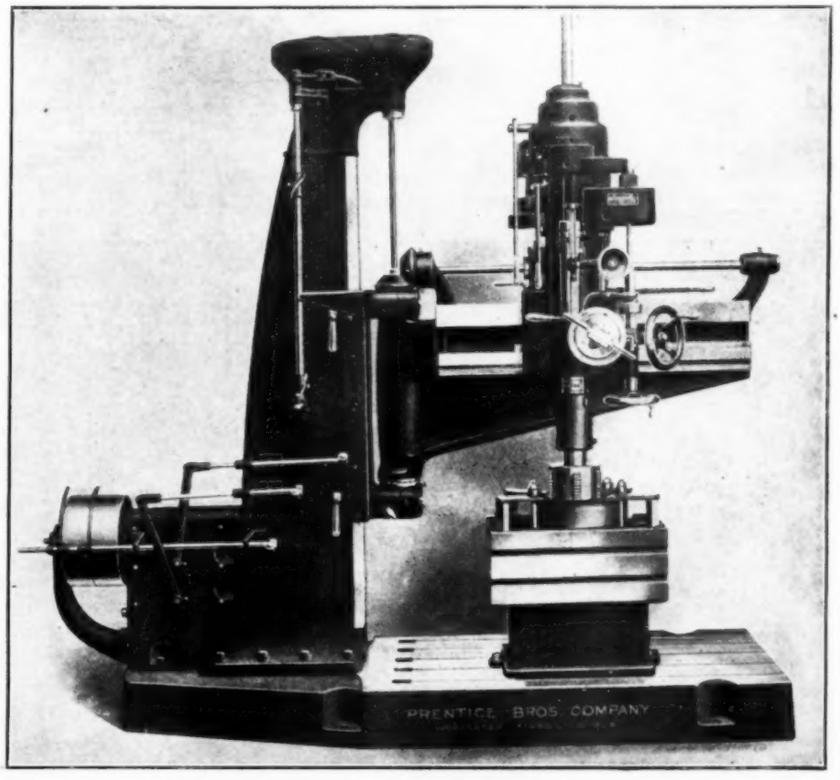
To guard against the careless manipulation of the operator, gear guards and safety devices have been embodied.

Ball bearings are used throughout the entire machine, with the exception of the feed mechanism. Sixteen spindle speeds are provided; four in the speed box multiplied by four in the head. The back gears, together with the high-speed and the low-speed gearing, constitute the four changes in the head. The high- and low-speed ratios are provided in the head so that when performing heavy work all the shafting and gears back of the head are relieved from excessive stress, and when running the spindle at high speeds for small holes the shafts and gears are relieved from racing.

To eliminate any possibility of injury, should the counterbalance weight chain break, a simple, efficient eccentric lock is provided, which is released by the breaking of the chain and is forced by a coiled spring against the notched side of the guide, and prevents the weight from falling.

A safety stop motion is provided for the raising and lowering of the arm which automatically disengages the tumbler gears at the top of the column.

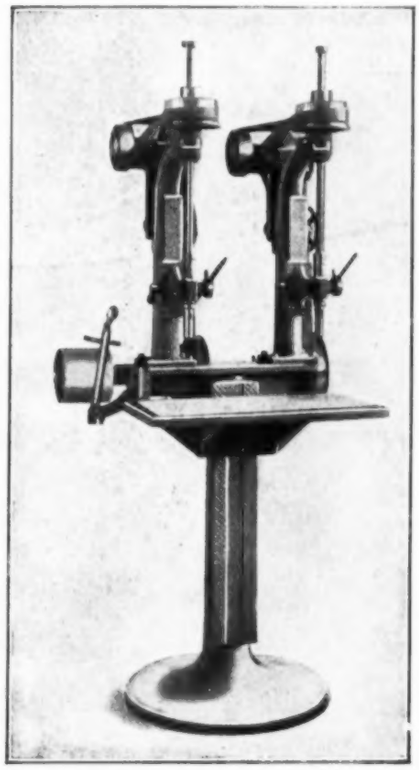
There are eight geared feed changes; friction back gears and friction tapping attachment, which may be engaged or disengaged while the machine is in motion; quick-return device; automatic stop; a roller clutch, which will permit of hand-wheel feed ahead of the engaged power feed; dial-depth gage, always reading from zero; spiral pinion for hand traverse of head; permanently located wrenches; outboard bearing for driving pulley; binding devices; central location of all operating levers; large diameters of driving pulleys.



A Radial Driller

Multiple Spindle Driller

The accompanying halftone shows a multiple-spindle sensitive driller recently developed by the Washburn shops of the Worcester Polytechnic Institute. The machine is equipped with the same type belt tightener as the motor-driven type previously described.



Multiple-spindle Driller

The countershaft is made a part of the machine, being located at the rear of the column. The drive from the countershaft is by open belt to a jack shaft and then by quarter twist to the spindle pulley. Both the countershaft and the jack shaft are provided with ring-oiling bearings. The spindle pulley runs in an oil

bath. The machine has a capacity up to 9/16 inch in diameter, the spindle being bored to fit a No. 1 Morse taper. With the recommended speed for countershaft, 610 revolutions per minute, the spindle speeds are 610, 1016 and 1830 revolutions per minute. The machine weighs 715 pounds and the greatest distance to spindle is 40 inches. The driller is made with two, three and four spindles.

A High Speed Grinder

The Waltham Watch Tool Company, Springfield, Mass., has recently put on the market the high-speed grinder shown in the halftone. This grinder is built in two sizes to meet the demand for an internal grinder having a high-speed spindle which will accommodate the small wheels adapted for internal grinding and drive them at their correct cutting speeds.

Fig. 2 shows the spindle and quill, and indicates clearly the construction of the parts and the method of oiling. The casing *A* has inserted in its front end, a fixed bearing holder *C* secured by the set-

FIG. 1. HIGH-SPEED GRINDER

screw *F*, and in its opposite end an adjustable bearing holder *C*1, with a threaded adjusting collar *D*. The inner ends of these bearing holders contact with the shoulders *J*3, *J*3 of the spindle *J* and govern the endwise adjustment of the spindle. Inserted in the bearing holders are split taper bearings *G G*, made of bronze and in these are taper-adjusting screws *I I*. Threaded caps *B* and *B*1, having lever holes *B*2, bring pressure against the ends of the bearings *G G* and hold the parts firmly in place. Extending members *B*4 on the caps, enter recesses in the pulleys *N* and serve to protect the spindle and bearings from emery and dust. On the central part of the spindle are two collars or flanges *K*, which enter an oil reservoir and in their revolutions throw the oil freely to the walls and roof of the casing. A long trough *L* secured by screws *M* receives a portion of this oil and conducts it to the felt filtering pads *R*. It then flows through conduits to the bearings and spindle and back to the reservoir, as indicated by the arrows. Annular recesses in the caps *B* and *B*1 connecting with the channels *G*1, provide for the return to reservoir of any oil which may work beyond the ends of the spindle bearings. Oil holes *C*4 assist in keeping the shoulder bearings flooded. A sight glass *U* on the outside of the casing indicates the oil level.

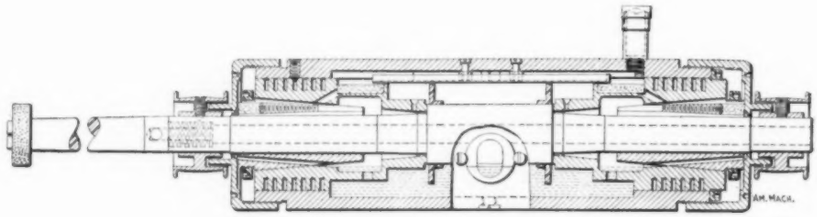


FIG. 2. THE SPINDLE AND QUILL

This spindle has run continuously for 10 hours at 30,000 revolutions per minute.

The table is operated by a reciprocating member, which receives its motion from a heart-shaped cam. The position of the roll which transmits the motion of the reciprocating member to the table can be altered while the machine is in motion, if desired, and any throw of the table from zero to the full throw obtained. With this reverse mechanism no space is necessary for the operation of the reverse mechanism.

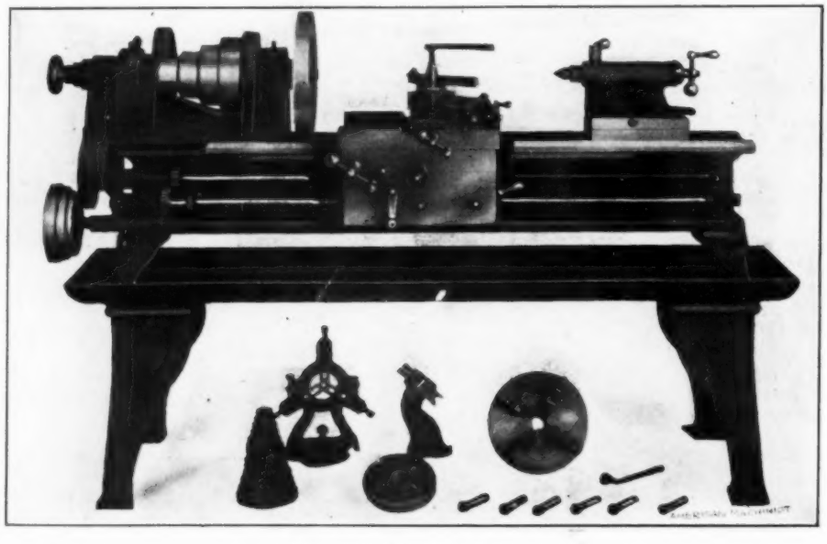
In a cam-operated machine it is important to have sufficient changes of feed to maintain a practically uniform rate of travel when the stroke of the cam is changed; for this reason 15 changes of feed have been provided. The feed can be instantly disengaged from the cam at any time.

For inspection or testing of work the table can be released, thrown back and returned to its previous setting. Table length No. 3 machine, 29 inches; No. 4 machine, 34 inches. Stroke No. 3, 0 to 4 inches; No. 4 machine, 0 to 6 inches. Swing No. 3 machine, 9 inches; No. 4 machine, 9¼ inches. Number of changes of feed No. 3 machine, 15; No. 4 machine, 21. Weight No. 3 machine, 900 pounds; No. 4 machine, 1300 pounds.

14-inch Engine Lathe

The accompanying illustration shows a new 14-inch lathe built by the Miami Valley Machine Tool Company, Dayton, Ohio.

The actual swing over the bed is 14¼ inches; hole through spindle 1⅛ inches. The spindle runs in large phosphor-bronze bearings and the carriage has three bearings on the bed, the third bearing giving additional support to the bridge. All bearings are hand scraped.



14-INCH ENGINE LATHE

A 16-inch Engine Lathe

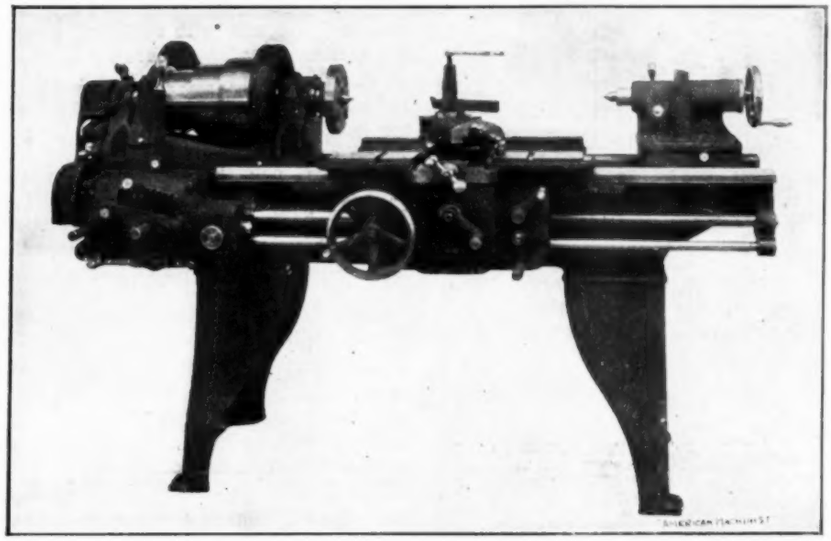
The halftone shows a 16-inch quick-change engine lathe built by the John B. Morris Machine Tool Company, Cincinnati, Ohio, for heavy-duty service.

The driving cone has three steps, 7⅛, 8⅝ and 10 inches diameter respectively, for 3½-inch belt. The back gears are of the double-friction type, with frictions of the toggle-lever type fitted with an automatic adjustment for wear. They are operated by the lever at the front of the head.

The spindle boxes are made of phosphor bronze with continuously oiling device. The front spindle bearing is 2¾ inches diameter by 4½ inches long.

The headstock is reinforced by longitudinal and cross ribs which extend below the shears. The gears in the reverse plate are supported at both ends.

The quick-change gear mechanism consists of the usual cone and tumbler gear combined with a system of sliding gears through which 45 changes of feed or thread leads are obtained with the use of 21 gears. All feed changes are obtained by means of the three levers shown on the front of the box, the one at the left being used only to secure the extreme range. The total range of the machine is from two to sixty threads per inch.



A 16-INCH ENGINE LATHE

The end of the lathe is fitted with the usual quadrant and quadrant gear for connecting up with the spindle so that it is possible to put on change gears to secure any special thread which might be required within the above range, making the machine capable of covering as wide a range in threads as can be obtained on an engine lathe of standard construction.

The feed rod and lead screw are engaged by means of a sliding gear operated by the nurled handle shown at the extreme right of the box, so arranged that when the lead screw is in operation, the feed rod is at rest and *vice versa*. This construction makes the quick-change box a complete mechanism within itself, and permits it being taken off the bed without disturbing the adjustment of the lead screw or feed rod.

All studs and gears in the apron are supported by a bearing at either end. It is impossible to engage the lead screw and feed rod simultaneously.

The frictions controlling the feeds are of the expanding ring type 5 inches in diameter, engaged by means of toggle lever movements which insure ample driving power, under the heavy cuts. These frictions are operated by a single crank handle shown on the front of the apron. When thrown to the right it engages the longitudinal feed and to the left it engages the cross feed. Provision is made in the shape of a positive stop which makes it impossible to throw the lever from one feed to the other without first pulling out the plunger pin in the handle, thus making it impossible to pass directly from the longitudinal to cross feed or *vice versa*.

The carriage has a bearing 26½ inches long on the bed, is carried on a V at the front 1½ inches wide, and on a flat surface at the back of the bed. It is held in position by a long flat clamp at the back and by means of two taper gibs at the front, which bear on the machined surface directly under the front V and prevent lifting of the carriage.

The bridge is wide and deep and, as the ways for the tailstock are below the ways for the carriage, it is not notched for clearance.

The compound rest is heavy to withstand the stresses imposed upon it by modern high-speed steel. The clamping device for the swivel is operated by a single bolt and consists of a V-shaped clamping ring similar in construction to that usually found on round-column radial drillers.

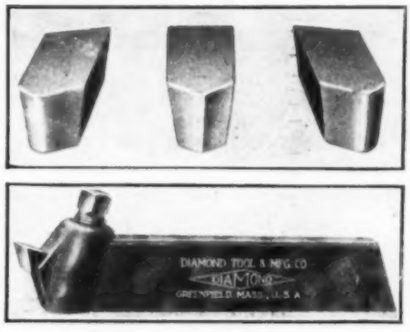
The tail spindle is 2⅞ inches diameter and is clamped by means of a taper plug of the same construction as that usually found on the overarm of milling machines. The tailstock is clamped to the bed by two large bolts coming up directly in front of and behind the tail spindle. These bolts reach to the top of the tailstock where the nuts are in a convenient place for the operator.

The bed is 11¾ inches deep and 14½ inches wide. The feed gears throughout the machine are made of steel; the lightest gear in this mechanism being 9 diametral pitch.

The lathe swings 16½ inches over shears and 10 inches over the carriage, and with a six-foot bed takes 2 feet 8 inches between centers and weighs approximately 2100 pounds.

Diamond Tool Holder

The halftone shows a tool holder in which the setscrew is of large diameter and the principal feature of which is the special shape of steel used. It is trapezoidal in shape instead of square, thus effecting economy in stock and eliminating most of the grinding. As will be noted, threading and turning shapes are shown.



DIAMOND TOOL HOLDER

The holder and tools are recent products of the Diamond Tool and Manufacturing Company, Greenfield, Mass.

Battery Truck Crane

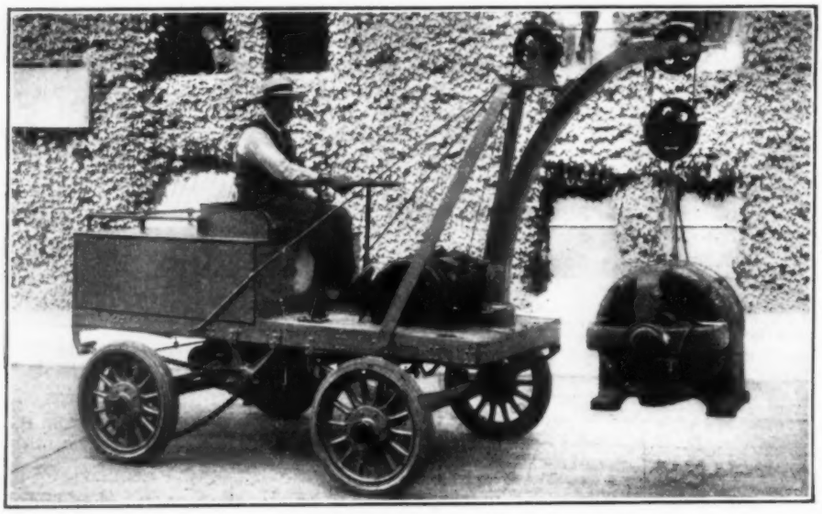
The accompanying halftone shows a battery truck crane, an electric vehicle which has a swinging crane mounted on the front end. The crane's hook is raised and lowered by a one-ton hoist, mounted on the front end just back of the crane, the motors driving the hoist and the vehicle being operated from a battery mounted on the rear end.

In cases where material which may be subdivided into parcels of one ton or less, has to be deposited within a 6- or 8-foot radius, and this action does not require that the parcel be moved through a

vertical distance of over 10 feet, the machine is brought into an advantageous position, the brakes are set, and the vehicle remains stationary as the boom of the crane moves back and forth between the picking up and depositing points. When material, in small or large quantities, has to be moved less than 400 feet or, in small quantities, to any distance, the article is lifted by the hook, conveyed to its destination by the vehicle, and placed on the floor, on a rack or a high pile, as desired.

The short wheel base permits making short turns, so this machine may readily be driven about shop aisles.

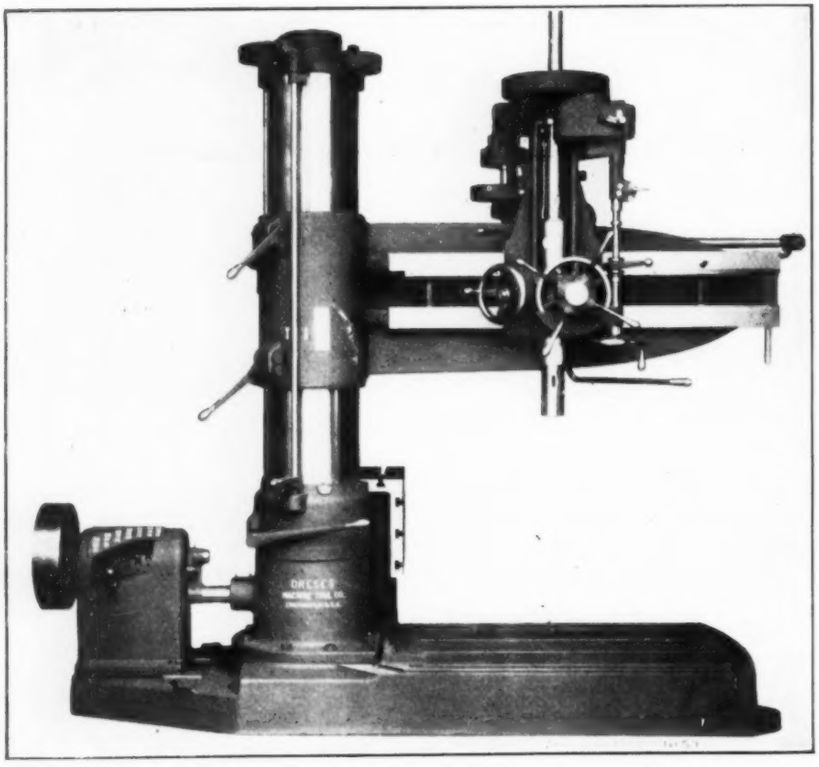
This truck crane is a recent product of the General Electric Company, Schenectady, N. Y.



BATTERY TRUCK CRANE

Plain Radial Driller

The accompanying photograph shows a 6-foot plain radial driller, recently developed by the Dreses Machine Tool Company, Cincinnati, Ohio.



PLAIN RADIAL DRILLER

The base of the machine has an oil groove cast all around, draining into a reservoir formed by the side ear under the table. The outer column swings on an inner fixed column reaching nearly to the top. Both are of large diameter at the lower end, and have an additional bearing in the middle. The arm-elevating gear has an automatic knockout at top and bottom. The elevating-screw thrust is taken by a ball bearing. The head has an additional bearing designed to distribute the torsional strain over the whole arm. The clamping and releasing are done by one handle.

The feed is all geared, has eight changes, and the feed worm runs in an oil bath. By means of a ratchet clutch the hand feed works ahead of the power feed.

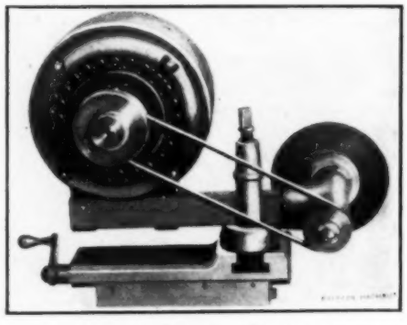
The automatic stop and depth gage consists of a swinging dog attached to an extension on the spindle sleeve and is brought in contact with an adjustable dog on the feed bar. Fixed to the adjustable dog is the graduated scale by which a predetermined depth of hole is gaged. Several dogs can be put on the feed bar and the swinging dog successively brought in contact with them for different depths. A safety release for the end of the feed is provided. The starting, stopping and tapping mechanism is of the frictional type.

The machine is built for the use of high-speed drills in 5-, 6- and 7-foot sizes, ranging in weight from 10,000 to 16,000 pounds.

Motor Driven Lathe Center Grinder

The accompanying halftone shows a motor-driven lathe center grinder recently developed by the Willey Machine Company, Jeffersonville, Ind.

The grinder is here shown in position on the compound rest of the lathe. The motor is mounted on the bar projecting from the tool post and drives the emery wheel through a round belt. This permits the use of a standard motor and of running the wheel at high speed.



LATHE CENTER GRINDER

The wheel is traversed at the proper angle for grinding centers by swiveling the compound rest and using screw feed. Centers of lathes having plain rests may be ground by taking a succession of cuts the width of the wheel, which is made in two sizes, ¼x4 inches and ⅜x6 inches, respectively.

Factory Development and Arrangement

(*Continued from page* 802)

be organized to itself do all the necessary work on a given unit of manufacture and how far parts of the work should be routed through special departments equipped for a particular kind of work. Some of these lines of division are well settled and we can pass them by and come to those where there is a difference of opinion and practice. For instance, it is hardly necessary to discuss the question as to whether there should be one foundry, forge shop, hardening room, smith shop, etc., to serve the whole shop, and the practice is almost universal to have general grinding, gear-cutting, screw-making and polishing departments, and have all work for such departments sent to the one department rather than having the machines for doing such work scattered throughout the works.

The more specialized the operations are the greater the reason for thus having the machines of a given kind together in a department to serve the whole shop. An argument in favor of such an arrangement is that it will require fewer machines to take care of a given product because there will be times of rush and times of idleness which can better be equalized if all the machines of a kind are together. This separating of machines of a given class into departments also makes it possible to put work in a size and kind of machine just suited to it, which is not always possible when these machines are scattered about the works. It might be contended that this same reasoning should extend to the locating of lathes, milling machines, drill presses, etc., as recommended under the "output department plan." Experience has taught, however, that a combination of these different methods of dealing with shop work is often of advantage and that it becomes a question of deciding in each particlar case where to draw the line to obtain, everything considered, the best results.

The Foreman Responsible for All Parts Belonging to His Unit

In such a line of manufacture as the spiral heads above referred to, even though much of the work may be said to be carried on on the "one-shop" plan, many of the operations are performed in other departments than that in which the spiral heads as a whole are built and many of the parts are made complete in other departments. For example, all the screws, studs and some small parts are made in the screw-machine department and carried in stock. The gears, while being turned in the department where the spiral heads are made, have their teeth cut in the gear-cutting department. The index plates are drilled in a special department equipped for precision work of this character, the graduating also being done in this same department. The grinding is all done in the general grinding department. The various parts, however, are made and the operations performed on order from the foreman having charge of the manufacture of spiral heads and he is held responsible for the completed work.

In deciding what course to pursue it all comes back to an examination of each particular case and its requirements to determine which of the methods before us for discussion, or what combination of them can be used to produce most economically the required results, and it is only by considering all the varying conditions that a satisfactory decision can be reached.

Increasing Shop Capacities

Metal Working

NEW ENGLAND

Fire badly damaged the machine shop of T. C. Fife, Woburn street, Reading, Mass.

George C. Nesbit will build a large garage in Crown street, near High, New Haven, Conn.

A. H. Eddy will open a large garage and repair shop in Windsor, Conn., in the near future.

John E. Boyle, Fairfield, Conn., has leased a building on Main street, which will be fitted up for a public garage.

The Costello Jewelry Company, with a capital of $10,000, has been incorporated and will locate a plant at Providence, R. I.

The contract has been let for a new factory building for Oliver M. Dean, broom manufacturer, Shrewsbury street, Worcester, Mass.

Work has been started on a new factory building to be erected for the Crane Valve Company, South avenue, Bridgeport, Conn.

The Boston & Albany Railroad will build a spring-manufacturing plant in addition to its shops at West Springfield, Mass., to manufacture all springs for its cars.

The Ames Plow Company, 100 Prescott street, Worcester, Mass., is to expend $10,000 for drills, shapers and lathes for its new plant at South Framingham, Mass.

The Meriden Press and Drop Company, Meriden, Conn., has incorporated with $50,000 capital to manufacture presses. Incorporators, Herman Hess, Henry M. Doolittle, C. H. Doolittle and Raymond P. Hess.

New England Collapsible Tube Company, New London, Conn., has been incorporated to manufacture and deal in tubes for toilet products, etc. Capital, $40,000. Incorporators, L. Tracy Sheffield, W. Kyle Sheffield and Nathan Belcher, all of New London.

The Rib Grip Company, of Hartford, Conn., has been incorporated to manufacture and deal in metal novelties. Capital, $100,000. Incorporators, Robert H. Lewis, Alvan Waldo Hyde and John S. Fitzsimmons, all of Hartford.

Century Gas and Electric Fixture Company, Bridgeport, Conn., has been incorporated to manufacture and deal in gas and electric fixtures, etc. Capital, $10,000. Incorporators, George Stiff, Harry C. Norrish, William Stiff and Robert C. Mallette, all of Bridgeport.

Work has been started on a new plant for the Gilbert & Barker Manufacturing Company, in West Springfield, Mass. There will be nine buildings, including sheet-metal shop, machine shop, furnace department, power house, etc. The concern manufactures gas machines, fuel-oil burners, furnaces, storage tanks, oil pumps, etc.

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

MIDDLE STATES

John Horach, Cleveland, Ohio, will erect a machine shop.

The White Auto Company, Cleveland, Ohio, will open a garage soon.

The Erie (Penn.) Forge Company will erect two manufacturing buildings.

The Acme Machinery Company, Cleveland, Ohio, is making additions to its shops.

The American Brass and Iron Company, Detroit, Mich., will erect a one-story foundry.

H. M. Ferguson, Morris, Ill., will erect a two-story general machine and auto repair shop.

The Hudson Motor Car Company, of Detroit, Mich., is erecting an addition to its plant.

The Whitesides Motor Truck Company, of Franklin, Ind., will move its factory to Newcastle, Ind.

J. Horach, 3704 East Forty-Ninth street, Cleveland, Ohio, has taken out a permit for a machine shop.

N. J. Sheridan will build a public garage at 2480-82 North Clark street, Chicago, Ill., and do general repairing.

The Detroit Insulated Wire Company, of Detroit, Mich., making insulated wire, is erecting a new factory.

The Acme Electric Heater Company, of Detroit, Mich., manufacturer of electric heaters, is erecting a new factory.

The Trenkamp Stove and Range Company, Cleveland, Ohio, is making large additions to its plant and equipment.

The new plant of the American Bridge Company, Gary, Ind., now employing 1200 men, will double its capacity.

Smith & Holtum, of Clinton, Wis., manufacturers of cement-workers' tools, will establish a factory at Janesville, Wis.

The Standard Steel Car Company, it is reported, has purchased additional land and will extend its plant at Lyndora, Penn.

The Scott Brothers Company, of Detroit, Mich., manufacturer of electrical equipment and supplies, is erecting a new factory.

James Keith & Blackman Company, Chicago, Ill., has been incorporated with $2000 capital to do a general machine business.

The Republic Metalware Company, of 89 Tennessee street, Buffalo, N. Y., has filed plans for a $22,000 addition to its factory.

The Defiance Pressed Steel Company, of Defiance, Ohio, has awarded a contract for the erection of a $25,000 plant at that place.

The Columbus Wire and Iron Works Company, of Columbus, Ohio, is preparing plans for a large addition to its plant on Poplar street.

Wells H. Press Company has acquired property at Streator, Ill., and will erect a factory for the manufacture of washing machines.

A. Stucki Company, Pittsburg, Penn., has been incorporated to manufacture iron and steel. Capital, $5000. Treasurer, A. Stucki, Pittsburg, Penn.

Metallic Alloys Company, Bradford, Penn., has been organized to manufacture bearings. Capital, $10,000. Treasurer, W. C. Leary, Bradford, Penn.

The Ohio Electric Company has purchased the old Bandy machine shops at Zanesville, Ohio, which will be remodeled and equipped as car-repair shops.

The Independent Can Company, Chicago, Ill., has been organized with $5000 capital to manufacture cans, etc., by W. J. Storit, Frank Mattoon, B. Raasch.

The Ford Brothers Auto Sales Company, of Toledo, Ohio, has been incorporated to do a general garage and repair business. G. R. Ford, principal stockholder.

Carbon Steel Company, Pittsburg, Penn., has been organized to manufacture iron and steel. Capital, $5000. Treasurer, Fred C. Shobert, Oliver building, Pittsburg, Penn.

C. S. Clark Manufacturing Company, Elgin, Ill., has been incorporated with $25,000 capital to manufacture farm implements by C. L. Clark, Samuel Peterson, A. W. Anderson.

The Standard Churn Company, Wapakoneta, Ohio, has been incorporated with $60,000 capital to manufacture churns by R. C. Hamman, S. A. Hoskins, W. H. Hamman, etc.

Comfort Hose Supporter Company, Chicago, Ill., has been organized to manufacture metal novelties by Dell S. Crosby, E. I. Frankhauser, Grover C. Niemeyer. Capital, $10,000.

Pennsylvania Can Lock Company, Monessen, Penn., has been incorporated to manufacture cans and locks. Capital, $25,000. Treasurer, Michael Heynik, Monessen, Penn.

McCallister Manufacturing Company, Harrisburg, Penn., has been formed to manufacture mechanical devices. Capital, $5000. Treasurer, Dickinson McAllister, Harrisburg.

The Virginia Aërial Manufacturing Company, Harpers Ferry, W. Va., has been incorporated with $100,000 capital to manufacture flying machines, etc. John C. Hagan, president.

Petry-Cassidy, Inc., Philadelphia, Penn., has been incorporated to manufacture automobiles. Capital, $10,000. Treasurer, Edward A. Cassidy, Delmar apartments, Germantown, Penn.

Gooch Koehler Specialty Manufacturing Company, Monaca, Penn., has been incorporated to manufacture machines and tools. Capital, $5000. Treasurer, Paulus E. Koehler, Monaca.

Case Crane Company, Pittsburg, Penn., has been incorporated to manufacture iron, steel and cranes. Capital, $5000. Treasurer, Chas. P. Carpenter, Sixteenth and Wood streets, Pittsburg.

Gawenda-Marko Manufacturing Company, West Berwick, Penn., has been organized to manufacture machinery of all kinds. Capital, $5000. Treasurer, John Marshay, West Berwick, Penn.

The Electric Lap Welding Machine Company, Cleveland, Ohio, has been incorporated to manufacture welding machinery by Geo. H. Tyler, Geo. W. Baesel, H. G. Stacey, etc. Capital, $50,000.

Central Fire Sprinkler Company, Chicago, Ill., has been incorporated with $10,000 capital to manufacture automatic water sprinklers, etc., by F. M. Peterson, M. Summers and A. J. Parker.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids November 14, for one riveter and punch for the Philadelphia Navy Yard as per Schedule No. 4030.

The Moore & Rigby Garage Company, Cleveland, Ohio, has been organied with $10,000 capital to do a general garage and repair business by W. H. Moore, John Moore, Albert B. Rigby, etc.

South Shore Garage Company, Chicago, Ill., has been incorporated with $12,000 capital to manufacture taxicabs and automobiles by Chas. M. Mudge, H. U. Mudge, L. C. Zoward, E. A. Fleming.

Pennsylvania Stove and Range Company, Spring City, Penn., has been organized to manufacture stoves, heaters and furnaces. Capital, $150,000. Treasurer, Wm. P. Miles, Spring City, Penn.

The Triumph Bed Spring Company, New Castle, Penn., has been organized to manufacture bed springs and house furnishings. Capital, $10,000. Treasurer, A. G. Zahnizer, New Castle, Penn.

The Watson Solar Window Company, manufacturer of metal sash, has leased the plant of the American Spiral Pipe Works, at 2502-22 South Paulina street, Chicago, Ill. Will add new machine tools.

The Stevenson Company, Pittsburg, Penn., has been incorporated to manufacture electrical machinery. Capital, $6000. Treasurer, Wm. D. Stevenson, 1221 Westinghouse building, Pittsburg, Penn.

Large Motor Truck Company, Pittsburg, Penn., has been incorporated to manufacture self-propelled vehicles. Capital, $25,000. Treasurer, Edwin L. Atkinson, 923 Mellon street, Pittsburg, Penn.

The Farmers Peat Fuel Machine Company, Indianapolis, Ind., has been incorporated with a capital of $75,000 by R. S. Lawrence, P. A. Lavallee and C. B. Marshall, to manufacture peat-pressing machinery.

The Pierce Arrow Motor Car Company, Buffalo, N. Y., has purchased site near its present plant and will erect a large plant to be devoted to the manufacture of auto trucks and commercial vehicles.

Woodward-Wanger Company, Philadelphia, Penn., has been organized to manufacture brass goods and machinery. Capital, $50,000. Treasurer, Geo. W. F. Keys, 1829 Pacific street, Philadelphia, Penn.

Harvey R. Pierce Company, Philadelphia, Penn., has been organized to manufacture surgical instruments. Capital, $25,000. Gustave A. Gussman, 1435 North Seventeenth street, Philadelphia, Penn.

The Indiana Gas Engine Company, Indianapolis, Ind., has been incorporated with a capital of $25,000 by G. G. Westerfield, I. W. Connaty, S. S. Brewer and Bernard Korbly, to manufacture gas engines.

The G. T. Eames Company, Saginaw, Mich., has been organized to manufacture machine tools, including a mandrel press invented by G. T. Eames. Incorporators, H. H. Everard, G. T. Eames, J. H. Penniman.

Pickett Hardware Company, Warren, Penn., has been incorporated to manufacture iron and steel, and furnaces, iron vats, etc. Capital, $100,000. Treasurer, Louis Brown, 215 Water street, Pittsburg, Penn.

The Hand Vacuum Sweeper Company, Pittsburg, Penn., has been organized to manufacture cleaners and sweepers. Capital, $10,000. Treasurer, Henry J. Thomas, 7211 Upland street, Pittsburg, Penn.

The Universal Cutting Machine Company, Cincinnati, Ohio, has been incorporated to manufacture all kinds of cutting machines by Victor E. Jullien, Albert J. Ryan, H. T. MacNaughton, etc. Capital, $15,000.

Earl Manufacturing Company, Philadelphia, Penn., has been incorporated to manufacture mechanical vibrators. Capital, $10,000. Treasurer, Edward E. Zeigler, 4335 Germantown avenue, Philadelphia.

The Queen City Electric Automobile Company, Buffalo, N. Y., has been organized to manufacture automobiles. Capital, $50,000. Incorporators, A. T. Towne, Kenmore; C. C. Chamberlain, M. T. Day, Buffalo.

East Greenville Manufacturing Company, East Greenville, Penn., has been organized to manufacture washing machines and household goods. Capital, $60,000. Treasurer, Francis S. Schelley, East Greenville, Penn.

The Start-O Company, Cleveland, Ohio, has been incorporated to manufacture acetylene motor starters and automobile and airship accessories by Henry P. Beckenbach, Hubert B. Fuller, E. L. Stoiber, etc. Capital, $10,000.

Mutual Wind Shield Manufacturing Company, Pittsburg, Penn., has been organized to manufacture motor vehicles, motor boats and aëroplanes. Capital, $12,000; treasurer, Geo. F. Ferrier, 313 Gross street, Pittsburg, Penn.

Philadelphia Truck Company, Philadelphia, Penn., has been incorporated to manufacture automobiles and other vehicles. Capital, $10,000. Treasurer, Roger W. Griswold, Twenty-Second and Chestnut streets, Philadelphia.

The Ideal Wrapping Machine Company, Middletown, N. Y., has been incorporated to manufacture wrapping machines, etc. Capital, $150,000. Incorporators, Olin S. Fellows, A. E. Hopkins, Fred B. Williams, all of Middletown.

The Marion Automobile Company, Dayton, Ohio, has been organized with $5000 capital to do a general automobile business, including operating a repair shop. Incorporators, Leslie B. Eaton, Frank W. Pennebaker, O. G. Stout, etc.

The Automobile Service Association, Philadelphia, Penn., has been organized to manufacture automobiles and motor vehicles. Capital, $15,000. Treasurer, Harry V. Elliott, Seventeenth street and Lehigh avenue, Philadelphia, Penn.

The S. R. Manufacturing Company, Schenectady, N. Y., has been incorporated to manufacture motors, engines, motor vehicles, etc. Capital, $50,000. Incorporators, Christian Steenstrup, Karl M. Rossi, Ralph J. Ury, all of Schenectady.

American Hollow Steel Sash Company, Philadelphia, Penn., has been organized to manufacture metal or wood window sashes and frames. Capital, $10,000. Treasurer, Raymond W. Tunnell, 251 West Walnut lane, Germantown, Penn.

The Paul Lacroix Automobile Company, New York, has been incorporated to manufacture and deal in motor vehicles. Capital, $10,000. Incorporators, Paul Lacroix, 353 West Eighty-Fifth street; Harry U. Kibbe, 258 Riverside drive, etc.

The Thermodyne Engine Company, New York, has been incorporated with $30,000 capital to manufacture engines, etc. Incorporators, Wm. Esson, 161 West One Hundred and Fifth street; W. H. Fritchman, L. T. Fetzer, 44 Pine street, New York.

The E. H. Wachs Company, at present operating a small engine shop at North La Salle and West Indiana streets, Chicago, Ill., has bought a site at Dayton and Blackhawk streets, and will build a modern shop and equip it with uptodate tools.

The H. O. Craven Manufacturing Company, of Waterford, N. Y., has been incorporated with $50,000 capital to manufacture carbureters for gasolene engines. Directors, H. O. Craven, Joseph A. Field and George R. Donnan, all of Schenectady, N. Y.

The Dodge & Goddard Manufacturing Company, Havard, Ill., has been incorporated for $150,000 to begin manufacturing high-speed milling cutters, hobs, dies, etc. Considerable machinery will be purchased. Factory under construction. Wm. S. Dodge is president.

A syndicate known as the Michigan Steel Company, of Detroit, Mich., will erect a large plant at Detroit, Mich., for the manufacture of open-hearth steel. Charles Baird, secretary of the Detroit Iron and Steel Company, is promoting the deal. The M. R. Hanna interests, of Cleveland, are interested also.

SOUTHERN STATES

The Pittsburg Steel Company is contemplating the erection of a steel plant in Baltimore, Md.

The University Motor Company wishes to erect a factory in Baltimore, Md., and is investigating property there to that end.

The Garage, the largest garage in America, located in Baltimore, Md., and owned by George Miller, will erect a large addition at Mount Royal avenue and Charles street, that city.

The Louisville Steel and Iron Company, with a capital of $400,000, will purchase the plant of the Louisville Bolt and Iron Company, Louisville, Ky., which has been idle several years, and after extensive improvements, will operate the plant.

WEST OF THE MISSISSIPPI

J. Patty is erecting a blacksmith shop at Fair Dealing, Mo.

Williams Brothers are enlarging their Main Street garage, at Poplar Bluff, Mo.

The Denver & Rio Grande railway is enlarging its shops at Salt Lake City, Utah.

The Missouri-Pacific Railway Company is increasing its shop capacity at Poplar Bluff, Mo.

The William Galloway Company, of Waterloo, Iowa, will erect a cream-separator factory.

W. R. Thatcher, of Oskaloosa, Iowa, has secured site for a factory to manufacture a dairy apparatus.

The Advance Machine Company, Compton avenue, Los Angeles, Cal., has taken out a permit to build a new pattern shop.

The Western Manufacturing Company, of Oskaloosa, Iowa (manufacture of hydrants, float valves, etc.), will erect a plant.

The St. Charles Land and Investment Company, of Charles City, Iowa, is securing the establishment of a gasolene-engine factory.

G. N. Scroggs, Los Angeles, Cal., has leased property on South Olive street, and will establish a plant for the manufacture of oil pumps.

The car barns of the Boise (Ida.) Electric Railway Company were totally destroyed by fire. Tools and equipment were demolished.

Wadhams & Co., Portland, Ore., has taken out a permit to build a commercial garage and repair plant on East Tenth street, Portland.

A. Mincke, Los Angeles, Cal., has leased property on North Clarence street and will establish a plant for the manufacture of steel trimmings.

Lloyd Allen, Columbus, N. M., will establish a modern blacksmith shop. The plant will be equipped to handle engine and pump repair work.

The Mount Hood Railway, Light and Power Company, Portland, Ore., contemplates the erection of car shops and repair plant in the Albina district.

The Reo Pacific Company, Los Angeles, Cal., has leased property on South Grand avenue, and will establish a commercial garage and repair plant.

The Dodd & Struthers Company, of Des Moines, Iowa, manufacturing lightning rods, will locate in Harrisburg, Penn., where a new building will be erected.

The Moreland Truck Company, Los Angeles, Cal., plans for the erection of a plant for the manufacture of motor trucks. W. L. Moreland is head of this company.

The Moore & Scott Iron Works, San Francisco, Cal., has acquired property on Second street, and is said to be contemplating the establishment of an addition to its plant.

The Landy Auto Company, Portland, Ore., has leased new quarters on Alder street, and will establish a modern commercial garage and repair plant. The plant will be fully equipped.

William Reaidt, Portland, Ore., has commenced the erection of three new buildings at Portland, to be used as commercial garages and repair plants. The plants will be fully equipped.

The Westinghouse Air Brake Company is having plans prepared by architect B. G. McDougall, San Francisco, Cal., for its new manufacturing plant to be erected at Emeryville, Cal., on property recently acquired.

Charles L. Perrin, Los Angeles, Cal., representing the Michigan Motor Company, has leased property on West Pico street, and will establish a commercial garage and repair plant. Modern equipment will be installed.

In connection with its new shops to be erected at Hillyard, Wash., the Great Northern railway will build a machine shop containing 21 engine pits, electric traveling crane and heavy machinery. Other buildings will also be erected.

The Klamath Falls (Ore.) Iron Works has acquired adjoining property, and will build an addition to its plant; the capacity will be increased and new machinery installed. A commercial garage will also be established. J. O. Beardsley is head of this company.

The California Malleable Iron Company, Riverside, Cal., recently organized, has taken over the plant of the Pacific Malleable Iron Company, near Riverside. The company will make many improvements in the plant, and will increase the capacity; new molding machinery will be installed. The company contemplates the removal of the plant to San Bernardino, and in such case will further augment the capacity.

CANADA

The Russell Motor Car Company will double its plant at Toronto.

E. W. Hume will equip a big new garage and shops at Calgary.

The city of Calgary will equip a big new municipal machine shop.

The Petrolia Auto Company, of Petrolia, Ont., is building a new plant.

D. Hicks is equipping a new garage and repair shop at Calgary, Alberta.

The Hamilton Bridge Company will erect a $150,000 plant in Hamilton, Ont.

The Climax Road Machine Company will locate a new factory at Hamilton, Ont.

The Western Canada Foundry Company will locate a new plant at Yorkton, Sask.

The Union Iron Foundry Company, of West St. John, N. B., will erect a new foundry there.

Canadian Iron Works, Vancouver, B. C., will erect a foundry and steel mill at Burnaby, B. C.

The Alberta Foundry and Machine Company will locate a new factory at Medicine Hat, Alberta.

Walsh's Holyoke Steam Boiler Works, of Holyoke, Mass., will locate a branch factory at St. Johns, Quebec.

The Oliver Chilled Plow Works, of Hamilton, will buy additional machinery. Lathes, derricks and forges required.

The Lightning Furnace Company, of Montreal, will equip a branch factory and foundry at St. Johns, Quebec.

E. H. Heaps & Co. will equip a large new machine shop for the building of motors, engines and autos at Vancouver, B. C.

A new foundry employing 300 men is shortly to be erected in Port Arthur by the Itikokan Iron Works, a subsidiary firm of the Canadian Northern.

The Winnipeg Ceiling and Roofing Company will equip a branch factory at St. Boniface, Manitoba. Among other machinery required will be an 80,000-pound press.

FOREIGN

John Tragardh & Co., Gothenburg, Sweden, are inquiring for machines for making iron and steel rivets.

GENERAL MANUFACTURING

NEW ENGLAND

The Lowell Shuttle Company, Lowell, Mass., will erect a dry house.

A sawmill is being built by Arthur Hasleton at Hudson Centre, N. H.

The Riverside Japannery, Mansfield, Mass., was damaged by fire. Loss, $8000.

The Hampden Woolen Company, at Southbridge, Mass., will erect a two-story addition.

The New Haven (Conn.) Gas Light Company will build an addition to the pump room.

Fire caused $10,000 damage to the woodworking plant of Glines & Stevens, Franklin, N. H.

The plant of the American Marbleized Slate Company, Fairhaven, Vt., was totally destroyed by fire. Loss, $10,000.

The Springvale (Me.) Spinning Company will erect an addition and install modern equipment.

The woodworking plant of Clines & Stevens, at Franklin, N. H., was destroyed by fire. Loss, $10,000.

Ernest Wye, of Needham, Mass., contemplates establishing a knitting plant at East Douglas, Mass.

The American Hide and Leather Company, Lowell, Mass., is to expend $110,000 for a new beaming and hide house.

The Robert Whittaker Company, Northboro, Mass., is to fit up a recently purchased plant for manufacturing woolen shoddies.

The Hygienic Brush Company, capitalized for $100,000, is to remove its plant from Worcester, Mass., to Leominster, Mass.

The Worcester (Mass.) Bleach and Dye Works, recently damaged by fire to the extent of $100,000, will be rebuilt immediately.

Plans are being drawn for changes to the boiler house and engine room at the plant of the Weibel Brewing Company, New Haven, Conn.

The Harvard Brewing Company, Lowell, Mass., has received a permit for alterations to the cold-storage plant. Estimated cost, $8000.

The plant of the H. H. Mathews Manufacturing Company, Seymour, Conn., was destroyed by fire. Loss, $75,000. Stove and other metal trimmings were manufactured.

The Webster & Southbridge Gas and Electric Company, Webster, Mass., will double the size of its plant. Four new boilers of 300 horsepower each will be added in the near future.

The Pawtucket (R. I.) Hosiery Company has formed with a capital of $100,000 for the purpose of engaging in general hosiery and knit fabric manufacturing and will locate in that city.

The Richard Murray Brick Company, Berlin, Conn., has incorporated with $50,000 capital to manufacture brick. Incorporators are Johanna M. Murray, Richard B. Murray and K. P. Murray.

Extensive improvements, to cost $40,000, will be made to the Curtis hotel, Lenox, Mass. A new laundry, bakery, boiler and engine house for heat and power, and an addition to its garage will be made.

Elmsville Worsted Company, Killingly, Conn., has been incorporated to manufacture and deal in worsted and woolen goods, etc. Capital, $50,000. Incorporators, Frank E. Holden, of Woonsocket, R. I., and James H. Barnett and Harry E. Back, both of Killingly.

MIDDLE STATES

The National Carbon Company, Cleveland, Ohio, will make additions to its plant.

The *Cleveland* (Ohio) *News* plans to erect and equip a modern newspaper plant soon.

Martin Brothers are erecting a pulp mill at Yaleville, one mile north of Norwood, N. Y.

Henry Perin and A. Mellen are preparing to erect a large broom factory at Hamlet, O.

Garfunckle & Wieman's flour mill, at Sharon, Penn., was entirely destroyed by fire.

The *Cleveland* (Ohio) *Leader* has plans out for a modern newspaper plant to be built for it.

Telling Brothers, Cleveland, Ohio, large ice-cream makers, are making additions to their plant.

The Baraboo (Wis.) Gas and Electric Company is planning the reconstruction of its plant.

The plant of the Marathon Paper mill, at Rothschild, Wis., was damaged by flood. Loss, $500,000.

The American Hard Rubber Company is erecting an addition to its plant at College Point, N. Y.

The main building of the Hartman Trunk Company's plant, at Racine, Wis., was burned. Loss, $150,000.

The Ohio Pottery Company, Zanesville, Ohio, will build a new plant to replace the one recently burned.

The National Electric Lamp Company, Cleveland, Ohio, will erect a large laboratory and other buildings.

Improvements will be made to the power plant of the Ohio agricultural experiment station, Wooster, Ohio.

Erie, Penn., will install a new 20,000,000-gallon pump. Chester & Fleming, Pittsburg, Penn., will prepare plans.

The Goodyear Tire and Rubber Company, Akron, Ohio, will build a large factory building near its present plant.

The Cleveland Peerless Laundry Company, Cleveland, Ohio, will need laundry machinery. Charles Bartles is manager.

The Angus Smith Company's big elevator at Milwaukee, Wis., was destroyed by fire. The loss will reach $400,000.

The Public Lighting Commission, of Detroit, Mich., is erecting a five-story building for use as a repair plant and store.

The Lillibridge Lumber Company, of Detroit, Mich., has let contract for a new mill on Grand River avenue, near Avery.

The Marietta (Ohio) Paint and Color Company is building an addition to its plant, which will double its present capacity.

Bessemer Brewing Company, 2648 East One Hundred and Sixth street, Chicago, Ill., will build a one-story addition to its plant.

Port Allegheny (Penn.) Furniture Works has been organized with a capital of $25,000. Treasurer, M. L. App, Port Allegheny, Penn.

The Pfeiffer Berlin Weiss Beer Company will build a two-story addition at its works, 2201-11 West Chicago avenue, Chicago, Ill.

The Republic Rubber Company, of Youngstown, Ohio, has increased its capitalization and will erect large additions to its plant.

The power plant and other buildings of the J. L. Stadler Company's rendering works, at Cleveland, Ohio, were destroyed by fire. Loss, $100,000.

At Norwalk, Ohio, plans are under way for the erection of a large ice-manufacturing plant. The Inter-State Ice Company is back of the deal.

The K. & H. Lamp Company, of Detroit, Mich., has been incorporated to manufacture automobile lamps, by Paul Krastin. Will need equipment.

David C. Jenkins, who owns a large glass factory employing 200 men, at Kokomo, Ind., is looking for another location to establish a branch factory.

G. F. Shuster Company, Philadelphia, Penn., has been incorporated to manufacture shoes. Capital, $25,000. Treasurer, Wm. S. Rendell, Mt. Holly, N. J.

The Cleveland (Ohio) Telephone Company has let a contract for the construction of a three-story exchange building at Lakewood. Equipment will be required.

The Enamel Vitrified Brick Company, Toledo, Ohio, incorporated for $500,000, will build and equip a modern plant. J. J. Urschel is president of the company.

At Woodville, Ohio, the plant of the Woodville Lime and Cement Company was totally destroyed by fire, entailing a loss of $150,000. The plant will be rebuilt at once.

Harwood & Von Rohl Piano and Player Piano Company, Reading, Penn., has been organized with $50,000 capital. Treasurer, Edward F. Harwood, Reading, Penn.

R. W. Howard, Kentland, Ind., has obtained a franchise to supply electric current to four neighboring towns. Work on a new power plant is already in progress.

T. E. Myer, J. T. Joyce and George W. Robertson incorporated the Myer Paper Box factory and will remodel the old power house for a factory at Eau Claire, Wis.

Mansell-Hunt-Catty Company, 22 Reade street, New York, paper, etc., is installing new equipment to cost $10,000. Part of order is still open, including hydraulic presses.

The Greeman Brothers Furniture Manufacturing Company, Lawrenceburg, Ind., has increased its capital from $75,000 to $150,000 and has begun the enlargement of its plant.

Isaac Lockhart & Sons, Philadelphia, Penn., has been organized to manufacture carpets. Capital, $35,000. Treasurer, Andrew Lockhart, 3745 North Gratz street, Philadelphia.

Conshohocken Ice Company, Conshohocken, Penn., has been incorporated to manufacture ice. Capital, $5000. Treasurer, Julian P. Wright, 112 North Broad street, Philadelphia, Penn.

Schellhammer & Co., Warren, Penn., has been incorporated to manufacture heating and ventilating systems and devices. Capital, $15,000. Treasurer, Ella A. Cochener, Warren, Penn.

The Fort Wayne Tile Company, Fort Wayne, Ind., has been incorporated with $7000 capital by Paul Koehler, Frank Kintz and J. H. Koehler, to manufacture hollow clay ware.

The Toledo Belting Company, Toledo, Ohio, has been incorporated with a capital of $10,000 to manufacture all kinds of belting by John D. Stalker, Geo. Cousino, M. L. Cousino, etc.

The Central Gas and Power Company, Evansville, Ind., has been incorporated with a capital of $10,000 by P. J. Scheller, H. J. Peckinpaugh and others to distribute electrical energy.

The Sterling Furniture Company, Indianapolis, Ind., has been incorporated with a capital of $20,000, by E. W. Bassett, F. B. Moreland and Baxter Denny, to do a manufacturing business.

The Wasmuch-Endicott Company, Huntington, Ind., has been incorporated with a capital of $20,000 by E. M. Wasmuch, H. A. Dinius and C. E. Endicott, to manufacture kitchen furniture.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids November 14, for oxygen-hydrogen generating plant for the Brooklyn navy yard as per Schedule No. 4031.

Bids are being received for the construction of an addition to the power plant of the Ohio agricultural experimental station, Wooster, Ohio. Information can be obtained of Director Chas. E. Thorne.

The Kompolite Company, manufacturer of floorings, wainscots and a magnesia-asbestos cement, has purchased a site and will erect a large factory at Kent avenue and North Eighth street, Brooklyn, N. Y.

Neville Concrete Company, Pittsburg, Penn., has been organized to manufacture structural materials for building purposes. Capital, $50,000. Treasurer, Edward M. Seibert, 22 North Fairmont street, Pittsburg.

Wylam Manufacturing Company, Philadelphia, Penn., has been organized to manufacture tags, labels and paper articles. Capital, $25,000. Treasurer, V. Winfield Challenger, 5710 American street, Philadelphia.

Power-plant equipment will be required for the 14-story office building to be erected for D. R. Hanna, Cleveland, Ohio. Plans have been drawn by Chas. A. Platt, 11 East Twenty-Fourth street, New York City.

The Regent Talking Machine Company, New York, has been incorporated to manufacture talking machines. Capital, $400,000. Incorporators, T. G. Dorey, Bronx; C. W. Fernald, Fanwood, N. J.; J. J. Cahn, New York.

The governing board of Muskegon, Mich., is planning a municipal electric-light and power plant by damming White river about 20 miles northwest of Muskegon, with the coöperation of the counties of Newyago and Oceana.

The Central Indiana Water, Light, Heat and Power Company, Francesville, Ind., has been incorporated with a capital of $125,000 by E. A. Rossiter, Edward Smalley and others, to supply nearby cities and towns.

The Disc-O'Phone Company, New York, has been organized to manufacture talking machines, records, etc. Capital $10,000. In-

corporators, Wm. G. Crumlish, Wilmington, Del.; Wm. F. Rea, 456 Broadway, New York, etc.

A. L. Draper, of Troy, N. Y., and A. T. Poole, of Lockport, N. Y., have purchased the Victor flour mill at Victor, N. Y., which has a capacity of fifty barrels a day, and are planning to enlarge to a capacity of 350 barrels a day.

SOUTHERN STATES

Danville, Va., will erect a municipal electric-light plant to cost $150,000.

Consumers Ice Company, Lexington, Ky., will erect an addition to its ice plant to cost $65,000.

Lawrenceville, Va., will issue $25,000 bonds for improvements to its lighting and water systems.

Virgina Fruit Growers, Inc Staunton, Va., contemplates the erection of a large cold-storage plant.

Wilson, N. C., will issue $74,000 bonds for improvements to its waterworks and electric-lighting systems.

Norfolk County Water Company, Norfolk, Va., will expend $300,000 for the installation of additional equipment.

The Kaul Lumber Company will erect a $300,000 plant at Tuscaloosa, Ala., to include planning mill shingle and last mills, etc.

The Exposition Cotton Mills, Atlanta, Ga., is erecting an additional building in which new machinery at a cost of $80,000 will be installed.

WEST OF THE MISSISSIPPI

T. J. Wallace, Corcoran, Cal., will install a new pumping plant.

The Phœnix Shingle Mill, at Ballard, Wash., was burned. Loss, $50,000.

The Bellingham (Wash.) Cement Company will erect a $1,000,000 cement plant.

The Methow Valley Creamery Association, of Twisp, Wash., will erect a creamery.

B. W. Barnard, Portland, Ore., will build a new carpenter shop on East Eighty-First street.

The Wise Manufacturing Company, of Webster City, Iowa, will erect a bottling works.

The Robinson Ice Cream House, at Central City, Neb., will build a bottling works and ice-cream factory.

The Mutual Telephone Company, Sherwood, Ore., has acquired property and will build a new exchange plant.

Crystal Ice Company, Argenta, Ark., will increase the capacity of its ice plant from 50 to 110 tons daily.

The Holland-St. Louis Sugar Company has let contract for the erection of a $1,000,000 plant in Decatur, Ind.

The Iowa Telephone Company, Davenport, Iowa, is erecting a new $75,000 plant at Sixth and Main streets.

The Sierra Light and Power Company, Corona, Cal., is having plans prepared for the reconstruction of its plant.

W. T. Darby, Los Angeles, Cal., has taken out a permit to build a boiler-room addition to his plant on West Sixth street.

The meat-packing plant of Pluym Brothers, Deer Park, Wash., was destroyed by fire. Loss, $16,000. The plant will be rebuilt.

The Virtue Mining Company, San Simon, Ariz., plans for the erection of an electric power plant in the Cave Creek cañon.

H. F. Tillotson, San Francisco, Cal., plans for the erection of a gas plant and system, at Tracy, Cal. A franchise has been asked.

M. R. & Alphonse C. Kane have acquired the business of the Eagle Chemical Company, and will enlarge the plant at Dubuque, Iowa.

The Union Irrigation Company, Tucson, Ariz., plans for the installation of pumping plant and irrigation system in the Red Rock district.

The Borst & Baker Oil Company, Coalinga, Cal., is planning to install machinery for oil drilling on its property in the Lost Hills district.

Edward Gillette, Taft, Cal., operating oil properties in this district, plans to install new electric motors for operation in the immediate future.

The Pacific Telephone and Telegraph Company, Los Angeles, Cal., will build a new exchange plant on Indiana and Lime streets, Escondido, Cal.

The Northwestern Realty Company, San Francisco, Cal., will install a pumping plant and water system on its property in the Marin Heights district.

The H. M. Gilbert Company, Toppenish, Wash., is planning for the erection of several pumping plants on property in the Yakima Indian reservation.

The Missouri Belting Company, St. Louis, Mo., has taken out a permit for a new factory to be erected at the corner of Grand avenue and La Salle street.

The Pacific Gas and Electric Company, San Francisco, Cal., is planning to extend its lighting and power systems in recently annexed territory of Sacramento, Cal.

The Great Shoshone & Twin Falls Water Power Company, Boise, Ida., is planning to install an electric-light and power system in South Boise. A franchise has been granted.

The Tulare County Power Company, Tulare, Cal., will install a lighting and power-distributing system in Tulare and vicinity. F. T. Billing is interested in this company.

The Hawthorne (Cal.) Furniture Manufacturing Company, near Los Angeles, contemplates the erection of an addition to its woodworking plant. New machinery will be installed.

The Sweet Home Water Company, Lebanon, Ore., recently incorporated, plans for the installation of a waterworks system near Lebanon. R. C. Watkins is interested in this company.

The mixing plant of the Barber Asphalt Paving Company, Los Angeles, Cal., was destroyed by fire. The loss is estimated at $8000. The plant will be rebuilt and new machinery installed.

The Granger (Wash.) Brick and Tile Company plans for extensive improvements and additions in its manufacturing plant. New machinery will be installed. A. W. Johnson is head of this company.

In connection with its new woolen mill plant, the Washington Woolen Company, Ellensburg, Wash., recently organized, will install an isolated power plant. J. H. Smithson is head of this company.

The Major Creek Lumber Company, White Salmon, Wash., recently organized, plans for the erection of a large sawmill and planing mill, near Major creek, in this district. Byron R. Dorr is head of this company.

The Rapid Systems Company, Hawthorne, near Los Angeles, Cal., manufacturer of blank books and kindred specialties, will establish an addition to its plant and increase the capacity; new machinery will be installed.

The Black Cañon Irrigation Company, Boise, Ida., plans for the installation of a modern irrigation system, with pumping plants and auxiliaries, near Horseshoe Bend. Estimated cost of the work, $7,000,000.

The Hart ranch, Shawnrita, near Tucson, Ariz., will install a central electric power plant with gas-engine units, and a number of pumping plants. Dietrich & Goetz, engineers, Tucson, are in charge of this work.

The Puyallup (Wash.) Veneer and Mill Company plans to rebuild its lumber and woodworking plant, recently destroyed by fire, at a loss of $90,000. The new plant will be fully equipped. A. P. Munson is manager.

The Rosedale Rural Telephone Company, Porterville, Cal., has been organized to install a telephone plant and system between Porterville, Worth and vicinity. A. Chalmers is president, and E. O. Giddings, vice-president.

The Oregon Wood Distilling Company, Portland, Ore., is planning for the erection of a wood-distilling plant for the manufacture of alcohol, oils, etc., near Oroville, Cal. The plant will be fully equipped. W. E. Young is president of this company.

The Sierra & San Francisco Power Company, San Francisco, Cal., plans to install a lighting and power system at Stockton, Cal. An auxiliary steam generating plant is also contemplated in that city. H. Jackson is assistant manager of this company.

The Palomas Highlands Water Users' Association, Tucson, Ariz., recently organized, plans for the installation of large pumping plants and an irrigation system on the Gila river. The work is estimated to cost $250,000. J. E. Nelson is head of this company. A gas-generating plant will be erected at Sentinel, Ariz.

The Alameda Sugar Company, Alvarado, Cal., has acquired a large tract of land at Meridian, Cal., and will remove its beet-sugar manufacturing plant. The present capacity will be doubled at the new location and complete equipment of machinery will be installed. About $2,500,000 will be expended. John L. Howard is president of this company.

CANADA

Beachville, Ont., will equip a new hydro-electric station.

The Heinz Pickling Company, of Rodney, Ont., will double its plant.

Stuart & Co., bakers, of Montreal, will build a new plant to cost $40,000.

The United Soap Company will build an addition to its plant at Maisonneuve, Que.

The Crown Timber Company, of Vancouver, will equip new sawmills at New Westminster, B. C.

The Graselli Chemical Company, of Cleveland, Ohio, will build a branch factory at Hamilton, Ont.

The Montreal & Southern Counties railway will erect new substations at St. Lambert and Chambly, Que.

Devonshire Manufacturing Company, confectionery, will build a new factory on Davenport road, Toronto.

The Herald Western Company, of Calgary, Alta., will equip a new plant. The latest printing machinery, electrical equipment and elevators will be installed.

The Powell River Pulp and Paper Company, of Vancouver, B. C., is about to make a large installation of paper machinery at its plant in British Columbia. Offices at Vancouver, B. C., and Minneapolis, Minn.

MINING

The Harqua Hala mine, near Yuma, Ariz., will build a 200-ton cyanide plant.

The Good Chance mine, Randsburg district, Cal., contemplates the erection of a cyanide plant.

The Globe Western Copper Company, near Globe, Ariz., plans for the erection of a 100-ton milling plant.

The San Cristobal mine, Parral district, Mex., plans for the installation of an aërial tramway. B. V. Gordon is manager.

At a meeting of the directors of the Ray (Ariz.) Central Copper Company, it has been voted to build a 1500-ton milling plant.

The Jumbo mine, near Lewiston, Ida., plans for the erection of a cyanide plant. M. M. Collette, Helena, Mont., is interested in this property.

The Consolidated mine, Hoga district, New Pine Creek, Ore., will increase the capacity of its stamp mill. New machinery will be installed.

The Big Tiger mine, Searchlight district, Nev., has commenced the erection of a milling plant. Russell & Davis operate this property.

The Ophir Hill Consolidated Mining Company, Ophir, Utah, plans to increase the capacity of its milling plant. New machinery will be installed.

The Sextuple mine, Searchlight district, Nevada, contemplates the erection of a cyanide plant and stamp mill. H. M. Benson is head of this property.

The West Kendall mine, Kendall, Mont., plans for the erection of a large cyanide plant. James Conley, Lewiston, Mont., is interested in this property.

The Nevada Mines and Selling Company, Hawthorne, Nev., plan for the erection of a concentrating plant in the Cat Creek district. F. B. House is head of this company.

The Ohio Copper Company, Bingham, Utah, will enlarge the capacity of its milling plant from 1700 to 3000 tons daily capacity. A contract for the building has been awarded.

The Red Bear Mining Company, Saric district, Sonora, Mex., has commenced the erection of a new stamp mill. The plant will be fully equipped. J. H. Haass is superintendent.

The stamp-mill plant of the Mammoth mine, Goldfield, near Mesa, Ariz., was partially destroyed by fire. The plant will be rebuilt. George U. Young is head of this property.

The Associated Placer Company, Lovelock, Nev., plans for the installation of new operating machinery and washing plant. A milling plant is contemplated in the immediate future. J. W. Wenzel is interested.

The Rocher de Boule mine, near Hazelton, B. C., plans to install a complete equipment of operating machinery; an electric power plant will be installed for operation of the property. A milling plant of 100 tons capacity is contemplated. John F. Cowan and Browning Brothers, Salt Lake City, Utah, are interested.

Business Items

Charles A. Schieren Company has just received notification to the effect that it has been awarded the Grand Prix at the Turin Exposition, now being held in Turin, Italy.

The Oeking Company, of New York, has been incorporated to sell the punching and shearing machines manufactured by the Stahlwerk Oeking, Düsseldorf, Germany, and has opened offices at 50 Church street, New York City. The management of the Oeking Company is in the hands of the Wiener Machinery Company.

The Hess-Bright Manufacturing Company, of Philadelphia, Penn., announces that it has received word from the Deutsche Waffen und Munitionsrfabriken, for whom it is importer, that the DWF ball bearings have just been awarded the "Gran Premio" at the International Industrial and Trade Exhibition, of Turin, this being the highest distinction.

Trade Catalogs

The R. K. LeBlond Machine Tool Company, Cincinnati, Ohio. Catalog. Lathes. Illustrated, 144 pages, 6x9 inches.

The Brown Hoisting Machinery Company, Cleveland, Ohio. Catalog. Locomotive cranes. Illustrated, 56 pages, 6x9 inches.

The White & Bagley Company, Worcester, Mass. Catalog. Economy grinding lubricant. Illustrated, 8 pages, 3x6 inches.

The Carborundum Company, 26 West Broadway, New York. Catalog. Niagara grinders. Illustrated, 22 pages, 3½x6 inches.

The Progressive Manufacturing Company, Torrington, Conn. Catalog. Machine screws, rivets, etc. Illustrated, 18 pages, 5½x8 inches.

Noble & Westbrook, Hartford, Conn. Catalog. Rubber and steel stamps, stencils, checks, name plates, etc. Illustrated, 56 pages, 6x9 inches.

Diamond Chain and Manufacturing Company, Indianapolis, Ind. Treatise and catalog. Power Chains and Sprockets. Illustrated, 96 pages, 6x9 inches.

Forthcoming Meetings

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month. Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month. Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Sachs' standardized tool requisitions; mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery built to order; modern plant; 30 miles from New York. Box 335, Amer. Machinist.

Wanted work in light stamped sheet-metal specialties. Bernardin Bottle Cap Company, Evansville, Ind.

Will buy or pay royalty for a good patented machine, tool, or attachment. Box 1372, New Haven, Conn.

Wanted—Screw machine work; send blueprints or samples for quotations. Remington Mfg. Co., Fitchburg, Mass.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Special machinery designed and built to order; tools, jigs, fixtures, sheet metal tools and stampings. Frank J. Dyett Co., Ilion, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Expert designing of difficult work; original work or redesigning special machinery and devices; high-class work only. Henry R. Evans, 3 West 29th Street, New York.

Wanted—Party who desires to secure a foundry which will give his work special attention and precedence; have well equipped iron and brass foundries and pattern shop. Box 500, American Machinist.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

Wanted—To rent or sell, new brick building, equipped with new machinery for manufacturing gas boilers, range boilers or iron barrels; will sell or rent on easy terms or will sell machinery separate. Write Lock Box 36, Big Run, Penn.

Technical patents are best taken care of by an engineering patent attorney, with sound practical experience, both as an engineer and as an attorney; highest references. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraph Company, Baltimore, Md.

Die and press tools from the simplest to most intricate designed and constructed by experts; will make dies to produce parts and articles of sheet metal at minimum cost; will manufacture parts from the tools if this is desired. Address Die and Press Department, The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

A company owning a modern and thoroughly equipped foundry, with capacity of 25 to 30 tons per day, with machine and pattern shops in connection, desire to connect themselves with parties having machinery to build, or who may have a patented article already on the market, or who may require medium or heavy castings; have had years of experience in gray iron castings and machine work, and can furnish highest references from present customers. Address Box 453, Am. Mach.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

INDIANA

Wanted—Practical machinist familiar with medium and heavy machine and assembly work, to analyze drawings into operations and supervise rate setting and time study work. Box 473, AMERICAN MACHINIST.

Wanted—Man familiar with medium and heavy machine work, with ability to devise best method of machining; must have a good working knowledge of the use and treatment of high-speed steel and be able to work on efficient combination of speeds, feeds and cuts. Box 474, AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—Experienced Gisholt lathe and vertical boring mill operators; must be first-class mechanics with good references. Box 460, AMERICAN MACHINIST.

Wanted—Traveling salesman, must have practical experience with modern machine tools; good reference is required. Box 464, AMERICAN MACHINIST.

Wanted—By manufacturer of automobile specialty, bright young man in inspection department for purchased goods; should have technical education, actual shop experience, and must be fair correspondent; man with some foundry experience preferred; state age, nationality, experience and salary expected. P. O. Box 22, Brightwood, Mass.

MICHIGAN

Wanted—A foreman for a light manufacturing plant to take charge of punch press and screw machine room; state age, references and wages desired. "G. R.," AM. MA.

NEW JERSEY

Chief draftsman wanted by prominent marine gasolene engine factory. Box 456, AM. M.

Wanted—An expert tool and die maker; permanent position at best wages to a man fully competent in every respect; state age, experience and wages wanted. Box 493, AMERICAN MACHINIST.

Wanted—First-class millwright and machinist to take charge of power plant and machine repair; must be able to handle men and run power economically; good references essential; state salary. Box 470, AM. MACH.

NEW YORK

Wanted—Experienced Gisholt lathe and vertical boring mill operators; must be first-class mechanics with good reference. Box 461, AMERICAN MACHINIST.

Wanted—First-class die maker; must thoroughly understand padlock work; give age, experience and salary expected. Box 475, AMERICAN MACHINIST.

Wanted—Traveling salesman, must have practical experience with modern machine tools; good reference is required. Box 463, AMERICAN MACHINIST.

Wanted—Metal pattern maker, experienced on valves and fittings preferred. In replying state age, married or single and wages expected. Box 492, AMERICAN MACHINIST.

Wanted—Active salesman for ball-bearing concern; good opportunity with growing business; state experience, age, and salary expected. Box 454, AMERICAN MACHINIST.

Wanted—Tool steel salesmen for all States to sell a leading brand of high-speed and carbon steels; write, giving particulars, age, salary expected, experience, territory covered, to Box 259, AMERICAN MACHINIST.

Opening for young man in cost office of large hardware factory in central New York; technical training and some accounting experience preferred; salary not less than $650 to start; an unusual opportunity in a modern plant. Box 494, AMERICAN MACHINIST.

OHIO

A first-class man for inspector of parts and special tools in a shop manufacturing machine tools; state age, past experience, references and wages expected. Box 491, AM. M.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 399, AMERICAN MACHINIST.

Wanted—Experienced Gisholt lathe and vertical boring mill operators; must be first-class mechanics with good references. Box 462, AMERICAN MACHINIST.

Second hand in textile machinery repair shop; a knowledge of looms is very desirable. Please reply fully, giving experience, age and salary expected. Box 484, AMER. MACHINIST.

Wanted—Draftsman familiar with designing milling machines, gear cutters and similar machinery; write fully, giving age and experience and salary expected. Box 477, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WISCONSIN

Wanted—Draftsman familiar with designing centrifugal pumps and other hydraulic machinery; location, Middle West. Box 419, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Salesman or representative of machinery or mechanical goods in Canada by person with 14 years' mechanical experience. Box 472, AMERICAN MACHINIST.

ILLINOIS

Tool draftsman and designer, 28, wants position; has shop experience and has held executive position in tool room; at present employed. Address Box 452, AMER. MACHINIST.

Uptodate mechanical engineer and expert is open for engagement after February next; 25 years' experience in designing and superintending manufacture of small high-class machinery, tools and fixtures. Box 495, AMERICAN MACHINIST.

Wanted—Position as superintendent or assistant superintendent of factory; practical machinist with engineering education, wide experience in electrical, engine and general machinery manufacturing; good organizer and executive; familiar with uptodate practice and methods; at present employed; age 40; married; 12 years' successful record in previous positions; Middle West preferred. Box 478, AMERICAN MACHINIST.

MASSACHUSETTS

Position as superintendent of machine shops or master mechanic of factory; first-class references; all-around man. Box 469, AM. MA.

MINNESOTA

Position wanted by a manufacturing superintendent, thoroughly experienced in best machine shop and foundry practice, a good organizer and executive who can get maximum output from men and tools. Box 357, AMER. MACHINIST.

NEW JERSEY

Master mechanic, foreman or superintendent, light machinery or sheet metal; able manager, wishes position. Box 502, AM. MA.

NEW YORK

Mechanical draftsman wishes position. Box 480, AMERICAN MACHINIST.

Superintendent would consider a change. Box 482, AMERICAN MACHINIST.

First class machine tool salesman wants position. Box 468, AMERICAN MACHINIST.

Experienced tool and machine designer wants position near New York. Box 483, AMERICAN MACHINIST.

As superintendent or manager with large concern, by man who has and is making good in this capacity. Box 504, AMER. MACH.

Position as superintendent or general foreman on interchangeable work by one who can deliver the goods. Box 479, AMER. MACH.

Business man, experienced as a salesman and buyer, wants position with first class machinery concern. Box 466, AMER. MACH.

Draftsman, automatic machinery, wants work; nine years' experience; quick, accurate; moderate salary. Box 489, AMER. MACH.

Designer of successful machine tools wants position as manager, superintendent or designer for first-class concern. Box 467, AM. M.

Position as head of stores and order department by young man with 10 years' experience; now employed; best references. Box 499, AMERICAN MACHINIST.

Chief of production and storekeeper; age 28, open for engagement; $2500 yearly; best reference from past and present employers. Box 498, AMERICAN MACHINIST.

Position as assistant foreman by experienced mechanic and draftsman; 15 years automatic machinery, shop tools, typewriters, etc. Box 490, AMERICAN MACHINIST.

Designer, technical graduate, 28, eight years' experience, automatic and general machinery, also experimental work, desires responsible position. Box 503, AMER. MACH.

Wanted—Position as salesman for Rochester, N. Y., and vicinity for machine shop, mill or manufacturing supplies; can furnish desirable references. Box 496, AM. MACH.

Position as expert assistant to general manager, desires high-grade mechanical engineer, where ability and intimate knowledge of manufacturing and general business conditions can be utilized. Box 497, AM. MACH.

Experienced purchasing agent, ten years with a large machinery manufacturing concern wants to connect with a manufacturer needing efficient service; wide acquaintance and modern methods. Box 465, AM. MACH.

Superintendent, tactful, diplomatic and aggressive, can take initiative in production and development of the business, hustle out the work, reduce costs, raise billing and show results; machinery, structural steel, foundry, tools and dies or manufacturing staple lines. "Mechanical Engineer," AMER. MACHINIST.

OHIO

Designer of motor trucks; will guarantee to obtain maximum simplicity, durability and silence of operation. Box 501, AMER. MACH.

PENNSYLVANIA

Two young men, mechanical foreman and draftsman, desire position in some southern State. Box 476, AMERICAN MACHINIST.

First-class machine tool designer desires change; 12 years' experience; fully competent for chief draftsman. Box 487, AM. MA.

Man, several years in charge of general machinery and furnace design, desires situation as chief draftsman or designer. Box 505, AMERICAN MACHINIST.

Superintendent, shop, foundry and engineering experience, capable executive, duplicate parts or heavy manufacturing a specialty, desires change. Box 430, AMER. MACHINIST.

A first-class mechanic with experience as foreman of machine shop, tool room, salesman and superintendent, wants position as superintendent; United States or Canada. Box 351, AMERICAN MACHINIST.

Superintendent or works manager, age 35 years, wishes change; systematizer, organizer, uptodate on shop practice; first-class mechanic, producer and cost reducer; correspondence solicited. Box 485, AMERICAN MACHINIST.

Young mechanical engineer (27), desires to represent reliable firm manufacturing machine tools, engines or pumps, etc., in any of the larger cities and adjacent territory; salary and commission proposition preferred. Box 486, AMERICAN MACHINIST.

Wanted—A position as manager or salesman by young man with technical education; has held both of above positions in automatic machine tool manufacturing concern; desires change owing to business conditions; position in or near Philadelphia preferred. Box 488, AMERICAN MACHINIST.

General foreman, age 28, will be open for position about November 1; eleven years' shop and drawing room experience; competent draftsman and experienced tool designer; desires position as assistant superintendent or some similar position with opportunity for advancement; location immaterial. Box 443, AMERICAN MACHINIST.

VIRGINIA

Mechanical engineer, draftsman, designer; college education, with wide and various experience on general engineering, desires good position. Box 415, AMERICAN MACHINIST.

FOR SALE

For Sale—Old established field mower business, situated in New England, consisting of patterns, some equipment material in process and good will; great opportunity for a small machine shop to purchase a going business; present manufacturers confining themselves to other lines. Box 471, AMER. MACHINIST.

Valuable manufacturing property, about 200 miles from New York City, consisting of machine shop, foundry, pattern shop, smith shop, power house, pattern storage, sheds, etc., suitable for manufacturing pumps, compressors, engines, tools or other machinery; equipment modern and in A-1 condition; railroad sidings into buildings; ten-ton traveling cranes; good shipping point, three railroad systems; fine labor and material market; an established business on a line of high grade machinery could go with plant, if desired, the manufacture of which would utilize a part of its capacity or might consolidate with other business or contract to manufacture other machinery. Box 294, AMER. MACH.

Talks With Our Readers

By The Sales Manager

The pyramids of Egypt form one of the seven wonders of the world.

They were built by the kings as tombs and everlasting monuments of their own greatness.

Only a few years ago did we begin to learn why they were built and what the numerous carvings and writings meant.

They were boastful stories of the great deeds performed during the life of the king and as such they give us a more or less hazy idea of Egypt as it was thousands of years ago.

Of the pyramids there are in all about seventy. The size of the Great Pyramid is appalling when we consider the times in which it was built.

Think of this one pile of stone containing 90,000,000 cubic feet of solid masonry! It is 480 feet high and 764 feet square at the base.

It is estimated that it took 360,000 men 20 years to build it.

Some of the stones are so big that we have no machines today powerful enough to move them.

They were handled by machinery of some sort, however, for the marks are still plainly seen after so many centuries.

This Great Pyramid stands exactly on the 13th parallel of latitude, and its four corners point exactly to the four cardinal points of the compass.

But how did they do it? How were those enormous stones set in place?

How did they harden copper and brass?

How did they make their wonderful dyes?

There are no records to show. These arts are lost—and lost completely.

The methods of Egypt died because there was no way to record them. Printer's ink, the great preserver, was not known. And so, while the accomplishments of Egypt were mighty, they were only useful for a limited time and restricted to a limited area and a comparatively few people.

Today, through the medium of engineering papers, modern methods of doing things are being faithfully recorded and spread broadcast. They are being advertised to a world which makes use of them.

If Egypt, wise and learned, had left records far less perfect in just the Selling Section of this paper, we would be going on where she left off. We would be using their advanced knowledge.

There are men today who are doing big things in the machinery-making field. Their deeds are written in improved machinery and recorded in the Selling Section.

In the gradual development of better methods and machines, we sometimes lose sight of the tremendous significance of this progress. Too many lose sight of progress itself and these are they who refer to the Selling Section as "mere advertising."

Advertising? Yes; but it's a reliable record of current events of our own history that none of us can afford to overlook.

* * *

Only reliable products can be continuously advertised.

ALPHABETICAL INDEX TO ADVERTISERS

PAGE

Abbott Ball Co. 121
Acme Machine Tool Co. 34
Acme Machinery Co. 121
Adams Co. 98
Adt & Son, John 99
Albro-Clem Elevator Co. 96
Allen Mfg. Co., Inc. 91
Almond Mfg. Co., T. R. 118
American Emery Wheel Wks. 111
American Gas Furnace Co. 102
American Pulley Co. 123
American Swiss File & Tool Co. 126
American Tap & Die Co. 110
American Tool Works Co. 8
American Vanadium Co. 106
Ames Co., B. C. 93
Armstrong-Blum Mfg. Co. 92
Armstrong Bros. Tool Co. 86
Athol Machine Co. 87
Atkinson Co., The 105
Auburn Ball Bearing Co. 122
Automatic Machine Co. 61

Baird Machine Co. 88
Baker Bros. 86
Baldwin Chain & Mfg. Co. 126
Barnes Co., W. F. & John 33
Barnes Co., Wallace 109
Barnes Drill Co., Inc. 89
Barnett Co., G. & H. 50
Bath Grinder Co. 65
Baush Machine Tool Co. 36
Bay State Stamping Co. 86
Bay State Tap & Die Co. 110
Beaman & Smith Co. 25, 118
Becker Milling Machine Co. 23
Bemis & Call Hardware and Tool Co. 86
Berger Mfg. Co. 104
Besly & Co., Chas. H. 127
Betton, J. M. 95
Betts Machine Co. 9
Bignall & Keeler Mfg. Co. 92
Bilgram Machine Works 97
Billings & Spencer Co. 117
Blaisdell Machinery Co. 95
Blake & Johnson Co. 112
Blanchard Machine Co. 77, 90
Bliss Co., E. W. 59
Blount Co., J. G. 111
Boker & Co., Hermann 73
Borden Co. 110
Boston Gear Works 96
Bradford Machine Tool Co. 5
Bradley & Son, C. C. 88
Bretz Co., J. S. 1
Bristol Co. 132
Brown & Co., R. H. 120
Brown Instrument Co. 117
Brown & Sharpe Mfg. Co. 55, 132
Brown Hoisting Machry. Co. 122
Brubaker & Bros., W. L. 110
Bryant Chucking Grinder Co. 42
Bullard Machine Tool Co. 70, 71
Burke Electric Co. 116
Butterfield & Co. 110

Calculagraph Co. 93
Caldwell Co., Inc., W. E. 126
Caldwell & Son Co., H. W. 97
Carborundum Co. 39
Card Mfg. Co., S. W. 11
Carpenter Tap & Die Co., J. M. 110
Carpenter-Tew Gear Co. 96
Carter & Hakes Machine Co. 87
Celfor Tool Co. 89
Chambersburg Engineering Co. 91
Champion Tool Works Co. 84
Chicago Flexible Shaft Co. 101
Chicago Pneumatic Tool Co. 94
Chicago Rawhide Mfg. Co. 99
Cincinnati Bickford Tool Co., 10, 11
Cincinnati Gear Co. 96
Cincinnati Gear Cutting Machine Co. 48
Cincinnati Lathe & Tool Co. 85
Cincinnati Milling Mach. Co. .6, 7
Cincinnati Planer Co. 35
Cincinnati Shaper Co. 48
Cleveland Auto. Mach. Co. 18
Cleveland Planer Works 78
Cleveland Twist Drill Co. 132
Clough, R. M. 97
Coates Clipper Mfg. Co. 117
Coes Wrench Co. 32
Colburn Machine Tool Co. 79
Colonial Leather Co. 109
Columbus Caliper Co. 109
Columbus Die Tool & Mach. Co. 109
Cook Co., Asa S. 92
Covington Machine Co. 92
Cowdrey Machine Works, C. H. 116
Crucible Steel Co. of America. 103

PAGE

Curtis & Curtis Co. 91
Cushman Chuck Co. 120

Dallett Co., Thos. H. 95
Dart Mfg. Co., E. M. 86
Davenport Machine Tool Co. .. 91
Davis Machine Co., W. P. 74
Delaware Hard Fibre Co., Ltd. 121
Dessau's Sons, S. 111
Detrick & Harvey Mach. Co. 121
Detroit Twist Drill Co. 89
Diamond Chain & Mfg. Co. 126
Diamond Machine Co. 80
Diamond Saw & Stamping Wks. 99
Dickinson, Thos. L. 50
Dill Slotter People 90
Disston & Sons, Henry 69
Dixon Crucible Co., Jos. 108
Doehler Die Casting Co. 101
Dreses Machine Tool Co. 22
Drury Co., Limited, H. A. 101
Durbrow & Hearne Mfg. Co. 93

Earle Gear & Mach. Co. 97
Electric Welding Products Co. 105
Elmes Engineering Works, Chas. F. 91
Errington, F. A. 119
Evans Friction Cone Co. 122
Excelsior Needle Co. 92

Fawcus Machine Co. 96
Fellows Gear Shaper Co. 24
Ferracute Machine Co. 91
Firth-Sterling Steel Co. 100
Flather & Co., Inc. 83
Flather Mfg. Co., E. J. 98
Foote Bros. Gear & Mach. Co. 98
Foote-Burt Co. 92
Fosdick Machine Tool Co. 32
Franklin Mfg. Co. 104

Gang Co., W. E. 89
Gardner Machine Co. 111
Garrigus Machine Co., C. G. .. 111
Garvin Machine Co. 77, 118
Gem Mfg. Co. 112
General Electric Co. 114
Geometric Tool Co. 34
Gilbert & Barker Mfg. Co. 104
Gisholt Machine Co. 85
Glidden Varnish Co. 108
Goodyear, Inc., Nelson 108
Gorton Machine Co., Geo. 90
Gould & Eberhardt 15
Graham Mfg. Co. 87
Grant Gear Works 96
Grant Mfg. & Mach. Co. 82
Gray Co., G. A. 28
Greaves, Klusman & Co. 85
Greene, Tweed & Co. 95
Greenfield Machine Co. 112
Grönkvist Drill Chuck Co. 120

Hammacher, Schlemmer & Co. 65
Harrington, Son & Co., Edw. .. 123
Hart & Cooley Co. 78
Hawkridge Bros. Co. 105
Heald Machine Co. 31
Hemming Bros. Co. 99
Hendey Machine Co. 61
Henry & Wright Mfg. Co. 30
Hilles & Jones Co. 82
Hoefer Mfg. Co. 82
Hoggson & Pettis Mfg. Co. 120
Holroyd & Co. 110
Holtzer-Cabot Electric Co. 116
Horsburgh & Scott Co. 98
Horton & Son Co., E. 118
Horton Machine Co., S. E. 118
Hoskins Mfg. Co. 105, 107
Hurlbut-Rogers Machine Co. 108
Hyatt Roller Bearing Co. 86

Independent Pneu. Tool Co. 95
Ingersoll Milling Mach. Co. 14
Ingersoll-Rand Co. 95
International Corres. Schools. 109

Jacobs Mfg. Co. 119
Jessop & Sons, Inc., Wm. 108
Johnson Machine Co., Carlyle. 79
Johnson, Jr., Co., Inc., I. H. .. 85
Jones & Lamson Mach. Co., 12, 13, 50

Kearney & Trecker Co. 26
Kelly Co., R. A. 90
Kempsmith Mfg. Co. 27

Laidlaw-Dunn-Gordon Co. 94
La Salle Mach. & Tool Co. 112
Landis Machine Co. 110
Landis Tool Co. 57
Lapointe Co., J. N. 86
Lapointe Machine Tool Co. 43

PAGE

LeBlond Mach. Tool Co., R. K., 63, 132
Leland & Co., W. H. 89
Lincoln-Williams Twist Drill Co. 109
Link-Belt Co. 75
Lodge & Shipley Machine Tool Co. 4, 16
Long & Allstatter Co. 91
Lucas Machine Tool Co. 84
Lumen Bearing Co. 104

Machinery Forging Co. 102
Manning, Maxwell & Moore .. 128
Manufacturing Equipment and Engineering Co. 82
Maris Bros. 122
Marshall & Huschart Mch. Co. Co. 125
Marvin & Casler Co. 118
Massachusetts Saw Works 117
McCabe, J. J. 84, 124
McGraw-Hill Book Co. 76
Meisel Press & Mfg. Co. 98
Meisselbach-Catucci Mfg. Co. . 97
Merritt, Jos. 50
Millers Falls Co. 98
Milton Mfg. Co. 81
Milwaukee Machine Tool Co. . 87
Mitts & Merrill 88
Modern Tool Co. 113
Moore Co., Franklin 122
Morris Machine Tool Co., J. B. 85
Morrow Mfg. Co. 119
Morse Chain Co. 117
Morse Twist Drill and Mach. Co. 59
Morton Mfg. Co. 116
Motch & Merryweather Machinery Co. 124
Mueller Machine Tool Co. 90

National-Acme Mfg. Co. 130
National Brake & Electric Co. 95
National Machine Co. 91
National Machinery Co. 91
National Tube Co. 108
Nazel Engr. & Machine Wks. . 88
New Britain Machine Co. 106
New Haven Mfg. Co. 83
New Process Raw Hide Co. 98
Newark Gear Cutting Machine Co. 98
Newton Machine Tool Wks. 19
Niagara Machine & Tool Wks. 90
Nicholson & Co., W. H. 121
Nicholson File Co. 17
Niles-Bement-Pond Co. 2, 3, 46
Northern Engineering Wks. 122
Norton Co. 69
Norton Grinding Co. 68
Norwalk Brass Co. 106
Nuttall Co., R. D. 96

Oneida Steel Pulley Co. 123
Osgood, J. L. 93
Oesterlein Machine Co. 28
Otto Gas Engine Co. 116

Page-Storms Drop Forge Co. . 86
Pangborn Co., Thomas W. 95
Parker Co., Chas. 87
Paxson Co., J. W. 108
Philadelphia Gear Works. 96
Phosphor Bronze Smelting Co. 102
Poole Engineering & Mach. Co. 97
Potter & Johnston 20, 21
Powell Machine Co. 37
Pratt & Whitney Co. 47
Pratt Chuck Co. 118
Precision Die-Casting Co. 102
Prentice Bros. Co. 29
Prentiss Tool & Supply Co. 124

Ransom Mfg. Co. 113
Recording Register & Fare Box Co. 93
Reed Co., F. E. 45
Reed Mfg. Co. 87
Reliance Electric & Engineering Co. 116
Revolute Machine Works. 113
Rhineland Machine Works. 121
Richmond Electric Co. 116
Rivett Lathe Mfg. Co. 131
Rochester Boring Machine Co. 125
Rockford Drilling Mach. Co. . 127
Rockwood Mfg. Co. 122
Rogers & Hubbard Co. 107
Root Co., C. J. 93
Roth Bros. & Co. 116
Rowbottom Machine Co. 112
Royersford Fdry. & Mach. Co. 90
Rummel Machine Screw Co. ... 92

Safety Emery Wheel Co. 111
S. K. F. Ball Bearing Co. 74
Sanford Mfg. Co., F. C. 108

PAGE

Saunders' Sons, D. 92
Sawyer Gear Works 96
Schieren Co., Chas. A. 95
Schuchardt & Schütte. . 25, 93, 120
Schumacher & Boye 22
Sebastian Lathe Co. 84
Sellers & Co., Inc., Wm. 40
Seneca Falls Mfg. Co. 80
Shaw Electric Crane Co. 122
Shepard Electric Crane and Hoist Co. 123
Shore Instrument & Mfg. Co. . 107
Shuster Co., F. B. 99
Sibley Mach. Tool Co. 39
Sigourney Tool Co. 89
Simonds Mfg. Co. 99
Simonds Mfg. Co., The 97
Simplex Mfg. Co. 98
Simplex Tool & Supply Co. 109
Skinner Chuck Co. 119
Sloan & Chace Mfg. Co. 42
Slocomb Co., J. T. 90
Smart Mfg. Co., A. J. 110
Smith & Mills Co. 126
Smooth-On Mfg. Co. 107
Sowers Mfg. Co. 107
Sprague Electric Works. 115
Springfield Machine Tool Co. . 49
St. Louis Sales Co. 121
Standard Engineering Wks. . 92
Standard Gauge Steel Co. 108
Standard Tool Co. 26
Stark Tool Co. 85
Starrett Co., L. S. 72
Sterling Emery Wheel Co. 113
Stoever Fdry. & Mfg. Co. 92
Sullivan Machinery Co. 94

Taft-Peirce Mfg. Co. 128
Tate, Jones & Co. 108
Taylor & Fenn Co. 113
Taylor-Wilson Mfg. Co. 97
Thompson & Son Co., Henry G. 99
Thwing Instrument Co. 93
Tindel-Morris Co. 98
Toledo Bridge & Crane Co. 122
Toledo Electric Welder Co. 107
Toledo Machine & Tool Co. .. 88
Toomey, Inc., Frank 125
Townsend Mfg. Co., H. P. 113
Trimont Mfg. Co. 73
Trump Bros. Machine Co. 120
Triumph Electric Co. 115

Underwood Co., H. B. 92
Union Drawn Steel Co. 103
Union Mfg. Co. 119
Union Twist Drill Co. 67
United Engineering & Fdry. Co. 88
U. S. Electrical Tool Co. 121
United Steel Co. 100
Universal Boring Machine Co. 113
Universal Electric Welding Co. 103
Universal Machine Screw Co. 92
Utica Drop Forge & Tool Co. . 116

Vanadium-Alloys Steel Co. 106
Vandyck Churchill Co. 98
Veeder Mfg. Co. 93
Vitrified Wheel Co. 111
Von Wyck Mach. Tool Co. 87
Vulcan Crucible Steel Co. 105

Walker & Co., O. S. 132
Waltham Machine Works. 85
Waltham Watch Tool Co. 125
Walworth Mfg. Co. 50
Ward & Sons, Edgar T. 100
Warner & Swasey Co. 44
Washburn Shops 112
Waterbury Farrel Fdry. and Machine Co. 50
Watson-Stillman Co. 95
Weeks, C. S. 86
Wennstrom's Sons Co., John. . 111
Wells & Son, F. E. 85
Wells Bros. Co. 110
West Haven Mfg. Co. 99
West Steel Casting Co. 109
Western Electric Co. 123
Western Tool & Mfg. Co. 99
Westinghouse Elec. & Mfg. Co. 115
White & Bagley Co. 117
Whitlock Coil Pipe Co. 108
Whitman & Barnes Mfg. Co. . 81
Whitney Mfg. Co. 53
Whiton Machine Co., D. E. ... 120
Wiley & Russell Mfg. Co. 109
Wilkes-Barre Metal Drawing & Stamping Co. 105
Williams & Co., J. H. 78
Wilmarth & Morman Co. 113
Windsor Machine Co. 38
Woodward & Powell Planer Co. 87
Worcester Machine Screw Co. 92
Worcester Pressed Steel Co. ... 103
Wormer Mchry. Co., C. C. 125

Yale & Towne Mfg. Co. 123

CLASSIFIED INDEX *to* ARTICLES ADVERTISED

Abrasive Materials
American Emery Wheel Co...111
Carborundum Co.....39
Dessau's Sons, S.....111
Dickinson, Thos. L.....50
Norton Co.....69
Safety Emery Wheel Co.....111
Vitrified Wheel Co.....111

Accumulators, Hydraulic
Niles-Bement-Pond Co....2, 3, 46
Watson-Stillman Co.....95

Air Lifts
Chicago Pneumatic Tool Co...94
Ingersoll-Rand Co.....95

Alundum
See Grinding Wheels.

Arbor Presses
Barnes Co., W. F. & John....33
Niles-Bement-Pond Co....2, 3, 46
Wilmarth & Morman Co.....113

Arbors
Brown & Sharpe Mfg. Co..55, 132
Cleveland Twist Drill Co....132
Detroit Twist Drill Co.....89
Morse Twist Drill & Machine Co.....59
Pratt & Whitney Co.....47
Pratt Chuck Co.....118
Skinner Chuck Co.....119
Union Mfg. Co.....119
Union Twist Drill Co.....67
Whitman & Barnes Mfg. Co..91
Whitney Mfg. Co.....53
Wilmarth & Morman Co.....113

Babbitt Metals
Lumen Bearing Co.....104

Balls, Steel
Abbott Ball Co.....121
Auburn Ball Bearing Co.....122
Boker & Co., Hermann.....73
Bretz Co., J. S.....1

Barrels, Tumbling
Abbott Ball Co.....121
Baird Machine Co., The.....88

Bars, Boring
Beaman & Smith Co.....25, 118
Cleveland Twist Drill Co....132
Elmes Engineering Works, Chas. F.....91
Niles-Bement-Pond Co....2, 3, 46
Underwood Co., H. B.....92

Bearings, Ball and Roller
Auburn Ball Bearing Co.....122
Boston Gear Works.....96
Bretz Co., J. S.....1
Hyatt Roller Bearing Co.....86
Rhineland Machine Works....121
Royersford Fdry. & Mach. Co. 90
S. K. F. Ball Bearing Co....74
Worcester Pressed Steel Co..103

Bearings, Bronze
Norwalk Brass Co.....106
Lumen Bearing Co.....104

Bearings, Die-Cast
Doehler Die Casting Co.....101
Franklin Mfg. Co.....104
Precision Die-Casting Co.....102

Belt Clamps
Billings & Spencer Co.....117
Hoggson & Pettis Mfg. Co....120

Belt Dressing
Dixon Crucible Co., Joseph...108
Link-Belt Co.....75
Schieren Co., Chas. A.....95
White & Bagley Co.....117

Belt Fasteners
Bristol Co.....132

Belt Filler
Schieren Co., Chas. A.....95

Belting, Leather
Chicago Rawhide Mfg. Co....99
Colonial Leather Co.....109
Schieren Co., Chas. A.....95

Benches, Work
Brown & Sharpe Mfg. Co..55, 132
Manufacturing Equipment and Engineering Co.....82
Western Tool & Mfg. Co.....99

Bending Machinery, Hydraulic
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm.....40

Bending Machines, Plate
Long & Allstatter Co.....91
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm.....40
Toledo Mach. & Tool Co.....88

Bending Machines, Power
National Machinery Co.....91
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm.....40

Blanks, Nuts and Screw
Electric Welding Products Co., 97

Blocks, Chain
See Hoists, Hand

Blocks, Driving
Nicholson & Co., W. H.....121

Blowers
American Gas Furnace Co....102
Chicago Flexible Shaft Co...101
Garwood Electric Co.....80
General Electric Co.....114
Niles-Bement-Pond Co....2, 3, 46
Roth Bros. & Co.....116
Westinghouse Elec. & Mfg. Co.115

Blue Print Machines
Revolute Machine Co.....113

Blue Print Paper
Revolute Machine Co.....113

Bolt and Nut Machinery
Acme Mchry. Co.....121
Davis Machine Co., W. P.....74
Detrick & Harvey Mach. Co..121
Foote-Burt Co.....92
Harrington, Son & Co., Edwin 123
Landis Machine Co.....110
McCabe, J. J.....84, 124
Motch & Merryweather Machinery Co.....124
National-Acme Mfg. Co.....130
National Machinery Co.....91
New Haven Mfg. Co.....83
Newton Machine Tool Wks....19
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co....124
Sellers & Co., Wm.....40
Standard Engineering Co....92
Waterbury Farrel Fdry. and Mach. Co.....50
Wiley & Russell Mfg. Co.....109

Bolts and Nuts
Electric Welding Products Co..105
National-Acme Mfg. Co.....130

Bone for Case-Hardening
Rogers & Hubbard Co.....107

Books, Technical
McGraw-Hill Book Co.....76

Boosters
Burke Electric Co.....116
General Electric Co.....114
Westinghouse Elec. & Mfg. Co.115

Boring and Turning Mills, Vertical
American Tool Wks. Co.....8
Baker Bros.....86
Betts Machine Co.....9
Bullard Machine Tool Co..70, 71
Colburn Machine Tool Co.....79
Flather Mfg. Co., E. J.....98
Gisholt Machine Co.....85
Harrington, Son & Co., Edwin. 123
Manning, Maxwell & Moore...128
Marshall & Huschart Machinery Co.....125
McCabe, J. J.....84, 124
Mitts & Merrill.....88
Newton Machine Tool Wks....19
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm.....40
Wormer Mchry. Co., C. C.....125

Boring, Drilling and Milling Machines, Horizontal
Barnes Co., W. F. & John....33
Beaman & Smith Co.....25, 118
Betts Machine Co.....9
Detrick & Harvey Mach. Co..121
Fosdick Mach. Tool Co.....32
Gisholt Machine Co.....85
Hoefer Mfg. Co.....82
Johnson Jr. & Co., I. H.....85
Lucas Machine Tool Co.....84
Manning, Maxwell & Moore...128
McCabe, J. J.....84, 124
Motch & Merryweather Machinery Co.....124
New Haven Mfg. Co.....83
Newton Machine Tool Wks....19
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co....124
Rochester Boring Machine Co.125
Rockford Drilling Mach. Co...127

Boring, Drilling and Milling Machines, Horizontal —*Continued.*
Sellers & Co., Wm.....40
Springfield Mach. Tool Co....49
Universal Boring Machine Co.113
Vandyck Churchill Co.....98

Boring Head, Offset
Marvin & Casler Co.....118

Boring Tools
Armstrong Bros. Tool Co....86
Grant Mfg. & Machine Co....82
Western Tool & Mfg. Co.....99

Boxes, Tote
Berger Mfg. Co.....104

Brazing
Goodyear, Inc., Nelson.....108
Sanford Mfg. Co., F. C.....108

Broaches
Lapointe Co., J. N.....86

Broaching Machines
Harrington, Son & Co., Edwin. 123
Lapointe Mach. Tool Co.....43
Pratt & Whitney Co.....47

Buckets, Coal
Link-Belt Co.....75

Bulldozers
Bliss Co., E. W.....59
National Machinery Co.....91
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...124
Toledo Mach. & Tool Co.....88

Burnishing Machinery
Abbott Ball Co.....121

Butt Drilling and Milling Machines
Shuster Co., F. B.....99

Cabinets, Tool
Armstrong Bros. Tool Co.....86
Hammacher, Schlemmer & Co. 65
Morse Twist Drill & Mach. Co. 59

Calipers
Athol Machine Co.....87
Brown & Sharpe Mfg. Co..55, 132
Columbus Caliper Co.....109
Schuchardt & Schütte..25, 93, 120
Slocomb Co., J. T.....90
Starrett Co., L. S.....72

Cam Cutting Machinery
Garvin Machine Co.....77, 118
Rowbottom Machine Co.....112

Cams
Bilgram Machine Works.....97
Boston Gear Works.....96
Rowbottom Machine Co.....112

Carbonizing
American Gas Furnace Co...102

Carborundum
See Grinding Wheels.

Cars, Industrial
Link-Belt Co.....75

Case-Hardening
American Gas Furnace Co...102
Chicago Flexible Shaft Co....101
Rogers & Hubbard Co.....107
Williams & Co., J. H.....78

Castings, Aluminum
Lumen Bearing Co.....104
Norwalk Brass Co.....106
Whitlock Coil Pipe Co.....108

Castings, Brass and Bronze
Atkinson Co., The.....105
Lumen Bearing Co.....104
Norwalk Brass Co.....106
Whitlock Coil Pipe Co.....108

Castings, Die Molded
Doehler Die Casting Co.....101
Franklin Mfg. Co.....104
Lumen Bearing Co.....104
Precision Die-Casting Co.....102
Veeder Mfg. Co.....93

Castings, Iron
Athol Machine Co.....87
Blaisdell Machinery Co.....95
Brown & Sharpe Mfg. Co..55, 132
Link-Belt Co.....75
Springfield Machine Tool Co..49
Taylor & Fenn Co.....113
Veeder Mfg. Co.....93

Castings, Steel
National Brake & Electric Co. 95
United Engr. & Fdry. Co....88
West Steel Casting Co.....109

Castings, Vanadium
American Vanadium Co....106

Cement, Iron
Smooth On Mfg. Co.....107

Centering Machines
Hendey Machine Co.....61
McCabe, J. J.....84, 124
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47
Wells & Son Co., F. E.....85
Whiton Mach. Co., D. E.....120

Centers, Planer
Carter & Hakes Mach. Co....87
Cincinnati Planer Co.....35
Morse Twist Drill & Mach. Co. 59
New Haven Mfg. Co.....83
Pratt & Whitney Co.....47
Reed Co., F. E.....45
Woodward & Powell Planer Co. 87

Chains, Driving
Baldwin Chain & Mfg. Co....126
Boston Gear Works.....96
Diamond Chain & Mfg. Co....126
Link-Belt Co.....75
Morse Chain Co.....117
Whitney Mfg. Co.....53

Chucking Machines
Acme Machine Tool Co.....34
American Tool Wks. Co.....8
Brown & Sharpe Mfg. Co..55, 132
Cleveland Automatic Machine Co.....18
Garvin Machine Co.....77, 118
Gisholt Machine Co.....85
Johnson Jr. & Co., I. H.....85
Jones & Lamson Machine Co., 12, 13, 50
LeBlond Mach. Tool Co., R. K., 63, 132
McCabe, J. J.....84, 124
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47
Potter & Johnston.....20, 21
Reed Co., F. E.....45
Warner & Swasey Co.....44
Windsor Machine Co.....38

Chucks, Drill
Almond Mfg. Co., T. R....118
Brown & Co., R. H.....120
Celfor Tool Co.....89
Cleveland Twist Drill Co....132
Cushman Chuck Co.....120
Detroit Twist Drill Co.....89
Grönkvist Drill Chuck Co.....120
Horton & Son Co., E.....118
Jacobs Mfg. Co.....119
Modern Tool Co.....113
Morrow Mfg. Co.....119
Morse Twist Drill & Mach. Co.....59
Niles-Bement-Pond Co....2, 3, 46
Pratt Chuck Co.....118
Skinner Chuck Co.....119
Standard Tool Co.....26
Trump Bros. Mach. Co.....120
Union Mfg. Co.....119
Whitman & Barnes Mfg. Co..91
Whitney Mfg. Co.....53
Whiton Mach. Co., D. E.....120
Wiley & Russell Mfg. Co.....109

Chucks, Lathe
Cushman Chuck Co.....120
Gisholt Machine Co.....85
Hoggson & Pettis Mfg. Co....120
Horton & Son Co., E.....118
Horton Machine Co., S. E....118
Jones & Lamson Machine Co., 12, 13, 50
Modern Tool Co.....113
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47
Pratt Chuck Co.....118
Skinner Chuck Co.....119
Union Mfg. Co.....119
Whiton Mach. Co., D. E.....120

Chucks, Magnetic
Walker & Co., O. S.....132

Chucks, Planer
Cincinnati Planer Co.....35
Harrington & Son Co., Edwin. 123
New Haven Mfg. Co.....83
Niles-Bement-Pond Co....2, 3, 46
Skinner Chuck Co.....119
Union Mfg. Co.....119

Chucks, Split
Ames Co., B. C.....93
Rivett Lathe Mfg. Co.....131
Sloan & Chace Mfg. Co.....42
Stark Tool Co.....85

Circuit Breakers
General Electric Co.....114
Westinghouse Elec. & Mfg. Co.115

The "Whitney"

Has Greater Power Than Any Other Milling Machine On The Market

Wide range with simple construction.

Greater Power than can be obtained on any other Hand Milling Machine of an equal size.

Vertical and Horizontal Feeds are independent. This feature permits work to be held close to the Table and makes the Machine a Profiler.

The Spindle Head has Vertical Lever Feed and is accurately counterbalanced.

As the Vertical Lever Feed is independent from the Table and the Head accurately counterbalanced, light Milling may be done on long or heavy pieces without danger of breaking cutters.

The Spindle is driven by interchangeable Side Driving pulleys, which, in connection with three Grade Cone on Back Shaft, gives six Spindle Speeds.

The Table has Hand Lever Feed, also Crank Feed operated by Rack and Pinion.

The Pinion Shaft is mounted in an eccentric bushing to allow for adjustment of pinion with rack.

Weight attachment is furnished for feeding both Head and Table automatically.

Adjustable stops are furnished for limiting the travel of both Head and Table in either direction.

Table has large Oil Pockets.

Elevating Screw for Knee is provided with Ball Bearing Thrust Collars for reducing friction.

Any number of Spindle Speeds may be obtained by making new side Pulleys.

Hand lever for table feed can be applied either side of the Table to suit the operator.

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24 Whitney Hand Millers in one department of The Underwood Typewriter Co.

The Whitney Mfg. Co., Hartford, Conn.

C. W. Burton, Griffiths & Co., London. Fenwick Freres & Co., Paris. F. G. Kretschmer & Co., Frankfurt a./M., Germany.

Manufacturers of Hand Millers, High Grade Driving Chains, Water Tool Grinders, "The Woodruff Patent System of Keying," Presto Chucks and Friction Tapping Devices.

Clamps
Brown & Sharpe Mfg. Co..55, 132
Hammacher, Schlemmer & Co. 65
Hoggson & Pettis Mfg. Co....120
St. Louis Sales Co.....121
Starrett Co., L. S..... 72
Western Tool & Mfg. Co..... 99
Williams & Co., J. H..... 78

Clocks, Time
Calculagraph Co..... 93

Clocks, Watchmen's
Holtzer-Cabot Electric Co....116

Clutches, Friction
Caldwell & Co., Inc., W. E....126
Caldwell & Sons Co., H. W... 97
Evans Friction Cone Co.....122
Johnson Mach. Co., Carlyle.. 79
Link-Belt Co. 75
New Haven Mfg. Co..... 83
Niles-Bement-Pond Co....2, 3, 46
Oesterlein Machine Co..... 28

Coal Handling Machinery
Link Belt Co..... 75

Coilers' Spring
Garvin Machine Co.....77, 118

Collets
Whitney Mfg. Co..... 53

Compound, Pipe Joint
Dixon Crucible Co., Joseph...108
Smooth-On Mfg. Co.....107

Compressors, Air
Blaisdell Machinery Co..... 95
Blanchard Machine Co....77, 90
Chicago Pneumatic Tool Co.. 94
Dallett Co., Thos. H..... 95
Independent Pneu. Tool Co... 95
Ingersoll-Rand Co. 95
Laidlaw-Dunn-Gordon Co..... 94
National Brake & Electric Co. 95
Sullivan Machinery Co..... 94

Compressors, Gas
Chicago Pneumatic Tool Co.. 94
Ingersoll-Rand Co..... 95

Conduit, Interior
Sprague Electric Works.....115

Cones, Friction
Evans Friction Cone Co.....122

Connecting Rods and Straps
Electric Welding Products Co.105
Standard Gauge Steel Co.....108
Tindel-Morris Co..... 98

Contract Work
Blaisdell Machinery Co..... 95
Blanchard Machine Co....77, 90
Cowdrey Mach. Wks., C. H...116
Meisel Press & Mfg. Co.... 98
Merritt, Jos..... 50
Morrow Mfg. Co.....119
Poole Engineering & Mach. Co. 97
Rowbottom Machine Co.....112
Sloan & Chace Mfg. Co..... 42
Taft-Peirce Mfg. Co.....128
Weeks, C. S..... 86

Controllers and Starters, Electric
General Electric Co.....114
Westinghouse Elec. & Mfg. Co.115

Conveying Machinery
Brown Hoisting Mchry. Co..122
Link-Belt Co..... 75
Manning, Maxwell & Moore...128

Coping Machines
Long & Allstatter Co..... 91
Niles-Bement-Pond Co....2, 3, 46

Corundum
See Grinding Wheels.

Cotter Pin Machinery
Shuster Co., F. B..... 99

Cotters
Cleveland Twist Drill Co....132
Morse Twist Drill & Mach. Co. 59
Shuster Co., F. B..... 99
Standard Tool Co..... 26
Union Twist Drill Co..... 67
Whitman & Barnes Co..... 91

Counterbores
Cleveland Twist Drill Co....132
Detroit Twist Drill Co..... 89
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Slocomb Co., J. T..... 90
Starrett Co., L. S..... 72

Counters, Revolution
Durbrow & Hearne Mfg. Co... 93
Grant Mfg. & Machine Co.... 82
Recording Register and Fare Box Co. 93
Root Co., C. J..... 93
Schuchardt & Schütte..25, 93, 120
Veeder Mfg. Co..... 93

Countershafts
Almond Mfg. Co., T. R.....118
Brown & Sharpe Mfg. Co..55, 132
Coates Clipper Mfg. Co.....117
Dill Slotter People..... 90
Evans Friction Cone Co.....122
Grant Mfg. & Mach. Co..... 82
LeBlond Mach. Tool Co., R. K. 63, 132
McCabe, J. J.....84, 124
Manufacturing Equipment and Engineering Co..... 82
Norton Grinding Co..... 68
Safety Emery Wheel Co.....111
Simplex Tool & Supply Co...109

Countershafts, Friction
Dill Slotter People..... 90
Evans Friction Cone Co.....122
Warner & Swasey Co..... 44
Wilmarth & Morman Co.....113

Counting and Printing Wheels
Doehler Die Casting Co.....101
Franklin Mfg. Co.....104

Counting Machines
Recording Register and Fare Box Co. 93

Couplers, Hose
Chicago Pneumatic Tool Co... 94
Independent Pneu. Tool Co... 95
Ingersoll-Rand Co..... 95

Couplings
Almond Mfg. Co., T. R.....118
Caldwell & Sons Co., H. W... 97
Davis Machine Co., W. P..... 74
National Tube Co.....108
Nicholson & Co., W. H.....121
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40
Standard Gauge Steel Co.....108

Cranes
Brown Hoisting Mchry. Co...122
Chicago Pneumatic Tool Co... 94
Link-Belt Co..... 75
Manning, Maxwell & Moore...128
Maris Bros..... 122
Moore Co., Franklin.....122
Niles-Bement-Pond Co....2, 3, 46
Northern Engineering Works.122
Sellers & Co., Wm..... 40
Shaw Electric Crane Co.....122
Shepard Electric Crane & Hoist Co. 123
Toledo Bridge & Crane Co....122
United Engr. & Fdry. Co..... 88
Vandyck Churchill Co..... 98
Yale & Towne Mfg. Co.....123

Crank Pin Turning Machines
Niles-Bement-Pond Co....2, 3, 46
Underwood Co., H. B..... 92

Crank Shafts
Standard Gauge Steel Co.....108
Tindel-Morris Co..... 98

Crucibles
Dixon Crucible Co., Jos.....108

Crushers
Niles Bement-Pond Co....2, 3, 46

Cupolas and Ladles, Foundry
Paxson Co., J. W.....108

Cutters, Milling
Adams Co..... 98
Becker Milling Machine Co... 23
Boker & Co., Hermann..... 73
Brown & Sharpe Mfg. Co..55, 132
Cleveland Twist Drill Co....132
Detroit Twist Drill Co..... 89
Ingersoll Milling Machine Co. 14
Kearney & Trecker..... 26
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Simplex Tool & Supply Co....109
Sloan & Chace Mfg. Co..... 42
Standard Tool Co..... 26
Union Twist Drill Co..... 67
Ward & Son, Edgar T.....100

Cutting-Off Machines
Armstrong Bros. Tool Co..... 86
Bignall & Keeler Mfg. Co..... 92
Brown & Sharpe Mfg. Co..55, 132
Davis Machine Co., W. P..... 74
Hurlbut-Rogers Mach. Co....108
Johnson Jr. & Co., I. H..... 85
McCabe, J. J.....84, 124
Newton Machine Tool Wks... 19
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...124
Simplex Tool & Supply Co....109
Tindel-Morris Co..... 98
Warner & Swasey Co..... 44

Cutting-Off Tools
Armstrong Bros. Tool Co..... 86
Billings & Spencer Co.....117
Cleveland Twist Drill Co....132
Pratt & Whitney Co..... 47
Western Tool & Mfg. Co..... 99

Cyclometers
Veeder Mfg. Co..... 93

Diamond Tools
American Emery Wheel Wks.111
Dessau's Sons, S.....111
Dickinson, Thos. L..... 50
Safety Emery Wheel Co.....111
Wennstrom's Sons Co., John..111

Dies, Sheet Metal
Bliss Co., E. W..... 59
Columbus Die, Tool & Mach. Co. 109
Ferracute Machine Co..... 91
New Haven Mfg. Co..... 83
Niagara Machine & Tool Wks. 90
Pratt & Whitney Co..... 47
Taft-Peirce Mfg. Co.....128
Toledo Mach. & Tool Co.... 88
Waltham Machine Works....125
Wilkes-Barre Metal Drawing & Stamping Co.....105

Dies, Sub-Press
Pratt & Whitney Co..... 47
Sloan & Chace Mfg. Co..... 42
Taft-Peirce Mfg. Co.....128
Waltham Machine Works....125

Dies, Threading, Opening
Boker & Co., Hermann..... 73
Errington, F. A.....119
Foote-Burt Co..... 92
Geometric Tool Co..... 34
Jones & Lamson Mach. Co., 12, 13, 50
Modern Tool Co.....113
Pratt & Whitney Co..... 47
Warner & Swasey Co..... 44

Drawing Boards and Tables
Washburn Shops.....112

Drawing, Pressed Steel
Wilkes-Barre Metal Drawing & Stamping Co.....105

Drill Speeder
Graham Mfg. Co..... 87

Drilling Compound
White & Bagley.....117

Drilling Machines, Bench
Barnes Co., W. F. & John.... 33
Hoefer Mfg. Co..... 82
Pratt & Whitney Co..... 47
Prentice Bros. Co..... 29
Rockford Drilling Mach. Co..127
Sigourney Tool Co..... 89
Sloan & Chace Mfg. Co..... 42
U. S. Electrical Tool Co.....121

Drilling Machines, Boiler
American Tool Works Co..... 8
Cincinnati Bickford Tool Co., 10, 11
Foote-Burt Co..... 92
McCabe, J. J.....84, 124
Niles-Bement-Pond Co....2, 3, 46
Prentice Bros. Co..... 29
Sellers & Co., Wm..... 40

Drilling Machines, Multiple Spindle
American Tool Wks. Co..... 8
Baker Bros. 86
Barnes Co., W. F. & John.... 33
Barnes Drill Co..... 89
Baush Mach. Tool Co..... 36
Cincinnati Bickford Tool Co., 10, 11
Foote-Burt Co..... 92
Fosdick Mach. Tool Co..... 32
Garvin Machine Co.....77, 118
Harrington, Son & Co., Edwin.123
Henry & Wright Mfg. Co..... 30
Hoefer Mfg. Co..... 82
Leland & Co., W. H..... 89
Manning, Maxwell & Moore...128
McCabe, J. J.....84, 124
Newton Mach. Tool Works.. 19
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Prentice Bros. Co..... 29
Prentiss Tool & Supply Co...124
Rockford Drilling Mach. Co..127
Sigourney Tool Co..... 89
Sellers & Co., Wm..... 40
Taylor & Fenn Co.....113

Drilling Machines, Portable
Coates Clipper Mfg. Co.....117
Dallett, Thos. H..... 95
Gem Mfg. Co.....112
Ingersoll-Rand Co..... 95
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Rochester Boring Machine Co.125
U. S. Electrical Tool Co.....121

Drilling Machines, Radial
American Tool Works Co..... 8
Baush Mach. Tool Co..... 36
Cincinnati Bickford Tool Co., 10, 11
Detrick & Harvey Mach. Co..121
Dreses Mach. Tool Co..... 22
Foote-Burt Co..... 92

Drilling Machines, Radial —*Continued.*
Fosdick Mach. Tool Co..... 32
Gang Co., Wm. E..... 89
Manning, Maxwell & Moore...128
Marshall & Huschart Machry. Co. 125
McCabe, J. J.....84, 124
Morris Mach. Tool Co., Jno. B. 88
Mueller Mach. Tool Co..... 90
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Prentice Bros. Co..... 29
Sellers & Co., Wm..... 40
Wormer Mchy. Co., C. C.....125

Drilling Machines, Rail
Foote-Burt Co..... 92
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40
Standard Tool Co..... 26

Drilling Machines, Turret
Niles-Bement-Pond Co....2, 3, 46

Drilling Machines, Upright
Baker Bros. 86
Barnes Co., W. F. & John.... 33
Barnes Drill Co..... 89
Beaman & Smith Co.....25, 118
Celfor Tool Co..... 89
Cincinnati Bickford Tool Co., 10, 11
Davis Machine Co., W. P..... 74
Foote-Burt Co..... 92
Fosdick Mach. Tool Co..... 32
Gould & Eberhardt..... 15
Harrington, Son & Co., Edwin.123
Henry & Wright Mfg. Co.... 30
Hoefer Mfg. Co..... 82
Leland & Co., W. H..... 89
Manning, Maxwell & Moore...128
Marshall & Huschart Machry. Co. 125
McCabe, J. J.....84, 124
Morse Twist Drill & Mach. Co. 59
New Haven Mfg. Co..... 83
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Prentice Bros. Co..... 29
Rockford Drilling Mach. Co..127
Sellers & Co., Wm..... 40
Sibley Machine Tool Co..... 39
Sigourney Tool Co..... 89
Sloan & Chace Mfg. Co..... 42
Taylor & Fenn Co.....113
Washburn Shops.....112
Wiley & Russell Mfg. Co.....109
Wormer Machry. Co., C. C....125

Drills, Center
Cleveland Twist Drill Co.. 132
Detroit Twist Drill Co..... 89
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Slocomb Co., J. T..... 90
Standard Tool Co..... 26
Whitman & Barnes Mfg. Co.. 91

Drills, Electric
Independent Pneu. Tool Co... 95
U. S. Electrical Tool Co.....121

Drills, Flat
Celfor Tool Co..... 89
Lincoln-Williams Twist Drill Co. 109
Pratt & Whitney Co..... 47
Whitman & Barnes Mfg. Co.. 91

Drills, Hand
Coates Clipper Mfg. Co.....117
Ingersoll-Rand Co..... 95
Niles-Bement-Pond Co....2, 3, 46
U. S. Electrical Tool Co.....121

Drills, Pneumatic
Chicago Pneumatic Tool Co.. 94
Independent Pneu. Tool Co... 95
Ingersoll-Rand Co..... 95

Drills, Ratchet
Armstrong Bros. Tool Co..... 86
Boker & Co., Hermann..... 73
Cleveland Twist Drill Co....132
Curtis & Curtis Co..... 91
Detroit Twist Drill Co..... 89
Parker Co., Chas..... 87
Pratt & Whitney Co..... 47
Standard Tool Co..... 26
Whitman & Barnes Mfg. Co.. 91

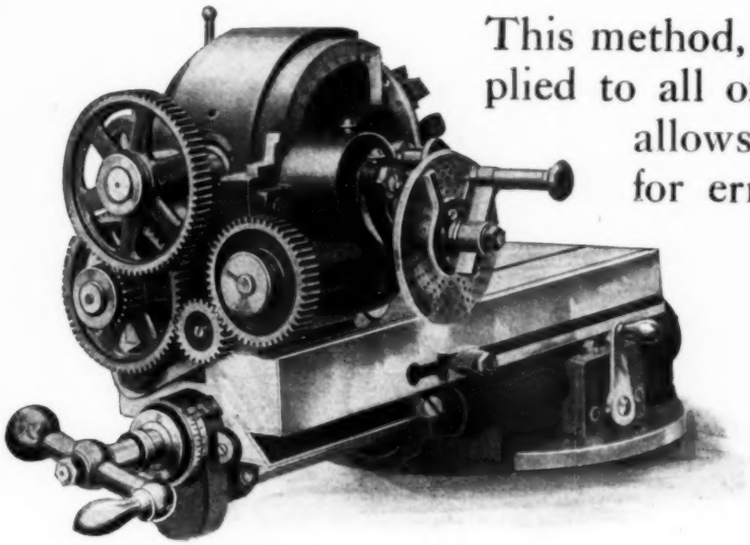
Drills, Rock
Chicago Pneumatic Tool Co.. 94
Ingersoll-Rand Co..... 95

Drills, Twist
Pratt & Whitney Co..... 47

Dynamometers, Electric
General Electric Co.....114
Sprague Electric Works.....115

Dynamos
Burke Electric Co.....116
General Electric Co.....114
Holtzer-Cabot Electric Co....116
Reliance Electric & Engr. Co. 116
Roth Bros. & Co.....116

Differential Indexing



This method, which has been applied to all of our Spiral Heads, allows little opportunity for error.

Method

The indexing of the spiral head spindle is positively made by gearing. The index plate is geared to the spindle, thus giving a differential motion that allows the indexing to be made with one circle of holes. Thus spacings can be made that cannot be obtained with an index plate locked with a stop pin in the usual way.

The Advantage

The index crank being moved the same as for plain indexing, it is necessary only to place the proper gears in position as indicated by the table that accompanies the machine. The change gears and index plates furnished with the machine provide for all divisions from 1 to 382, including all the prime numbers. Additional change gears and index plates give a large number of divisions beyond 382.

All of our Universal Milling Machines are regularly furnished with the spiral head and the Plain Milling Machines are built so that they may be thus equipped when it is so desired.

Write for booklet, "Differential Indexing."

Brown & Sharpe Mfg. Co.

Providence, R. I., U. S. A.

Dynamos—*Continued.*
Sprague Electric Works.....115
Triumph Electric Co.....115
Westinghouse Elec. & Mfg. Co.115

Electrical Instruments
Brown Instrument Co.....117

Electrical Supplies
General Electric Co.....114
Triumph Electric Co.....115
Westinghouse Elec. & Mfg. Co.115

Electro Plating
Wilkes-Barre Metal Drawing & Stamping Co. 105

Elevators
Albro-Clem Elevator Co., The. 96
Harrington, Son & Co., Edwin. 123
Link-Belt Co..... 75

Emery Wheel Dressers
American Emery Wheel Wks. 111
Dessau's Sons, S.....111
Diamond Saw & Stamping Wks. 99
Dickinson, Thos. L..... 50
Reed Mfg. Co..... 87
Safety Emery Wheel Co.....111
Standard Tool Co..... 26
Vitrified Wheel Co.....111

Emery Wheels
See Grinding Wheels.

Enamel Machinery
Glidden Varnish Co..... 108

Enclosures, Tool-Room
Hart & Cooley Co..... 78

Engineers, Mechanical or Electrical
Link-Belt Co..... 75
Merritt, Jos..... 50
Taft-Peirce Mfg. Co.....128
Weeks, C. S..... 86

Engines, Automobile
Doehler Die Casting Co.....101
Franklin Mfg. Co.....104

Engines, Gas and Gasolene
Automatic Machine Co. 61
Blaisdell Machinery Co..... 95
Crant Mfg. & Mach. Co 82
Otto Gas Engine Co.....116

Engines, Steam
Nazel Engr. & Mach. Wks... 88

Engraving Machinery
Gorton Mach. Co., Geo..... 90

Expanders, Tube
Chicago Pneumatic Tool Co.. 94
Nicholson & Co., W. H.....121
Pratt & Whitney Co..... 47
Watson Stillman Co..... 95

Fans, Electric
General Electric Co.....114
Sprague Electric Works.....115
Westinghouse Elec. & Mfg. Co. 115

Fans, Exhaust
General Electric Co.....114
Westinghouse Elec. & Mfg. Co. 115

Files and Rasps
American Swiss File & Tool Co. 126
Barnett Co., G. & H..... 50
Disston & Sons, Henry, Inc... 69
Hammacher, Schlemmer & Co. 65
Nicholson File Co..... 17
Simonds Mfg. Co..... 99
Whitman & Barnes Mfg. Co.. 91

Filing Machines
Betrick & Harvey Mach. Tool Co. 121
Grant Mfg. & Machine Co.... 82
Simplex Mfg. Co..... 98

Filler, Iron
National Tube Co.....108

Fittings, Hydraulic
Watson-Stillman Co..... 95

Fittings, Steam
National Tube Co.....108
Walworth Mfg. Co..... 50

Flanges
Dart Mfg. Co., E. M..... 86
National Tube Co.....108

Flexible Shafts
Chicago Flexible Shaft Co...101
Coates Clipper Mfg. Co.....117
Gem Mfg. Co.....112

Forges
Bradley & Son, C. C..... 88
National Machinery Co..... 91

Forgings, Drop
Billings & Spencer Co.....117
Bliss Co., E. W..... 59
Brown & Co., R. H.....126
Machinery Forging Co.....102
Page-Storms Drop Forge Co.. 86
Williams & Co., J. H..... 78

Forgings, Machine
Machinery Forging Co.....102
Tindel-Morris Co..... 98

Forgings, Steel
Crucible Steel Co. of America. 103

Forgings, Vanadium
American Vanadium Co.....106
Crucible Steel Co. of America. 103

Foundry Furnishings
Adams Co..... 98
Berger Mfg. Co.....104
Pangborn Company, Thos. W. 95
Paxson Co., J. W.....108

Frictions, Paper and Iron
Link-Belt Co..... 75
Rockwood Mfg. Co.....122

Furnaces, Annealing and Tempering
American Gas Furnace Co...102
Billings & Spencer Co.....117
Brown & Sharpe Mfg. Co..55, 132
Chicago Flexible Shaft Co...101
General Electric Co.....114
Gilbert & Barker Mfg. Co....104
Hoskins Mfg. Co.....105, 107
Simplex Tool & Supply Co....109
Tate, Jones & Co.....108

Furnaces, Coal and Oil
Gilbert & Barker Mfg. Co....104
Simplex Tool & Supply Co....109
Tate, Jones & Co.....108

Furnaces, Electric
Brown Instrument Co.....117
General Electric Co.....114
Hoskins Mfg. Co.....105, 107

Furnaces, Gas
American Gas Furnace Co...102
Chicago Flexible Shaft Co... 101
Gilbert & Barker Mfg. Co....104
Simplex Tool & Supply Co....109

Furnaces, Melting
American Gas Furnace Co...102
Chicago Flexible Shaft Co....101
Simplex Tool & Supply Co....109

Furnaces, Welding
Gilbert & Barker Mfg. Co....104
Sanford Mfg. Co., F. C.....108
Toledo Electric Welder Co...107

Furniture, Machine Shop
Berger Mfg. Co.....104
Hart & Cooley Co..... 78
Manufacturing Equipment & Engineering Co..... 82
Page-Storms Drop Forge Co.. 86
Western Tool & Mfg. Co..... 99

Gages, Dial
Ames Co., B. C..... 93

Gages, Recording
Bristol Co.....132
Brown Instrument Co.....117

Gages, Standard
Brown & Sharpe Mfg. Co..55, 132
Cleveland Twist Drill Co.....132
Grönkvist Drill Chuck Co....120
Henry & Wright Mfg. Co..... 30
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Slocomb Co., J. T..... 90
Starrett Co., L. S..... 72
Wells Bros. Co.....110

Gaskets
Smooth-On Mfg. Co.....107

Gear Blanks, Hard Fiber
Delaware Hard Fibre Co.....121

Gear Cutting Machinery
Adams Co..... 98
Becker Milling Machine Co... 23
Bilgram Machine Works..... 97
Brown & Sharpe Mfg. Co..55, 132
Carpenter-Tew Gear Co..... 96
Cincinnati Gear Cutting Machine Co..... 18
Cincinnati Shaper Co..... 18
Clough, R. M..... 97
Fellows Gear Shaper Co..... 24
Flather Mfg. Co., E. J..... 98
Foote Bros. Gear & Mach. Co. 98
Garvin Machine Co.....77, 118
Gould & Eberhardt..... 15
Harrington, Son & Co., Edwin. 123
Marshall & Huschart Machry. Co. 125
McCabe, J. J.....84, 124
Meisselbach-Catucci Mfg. Co.. 97

Gear Cutting Machinery—*Continued.*
Motch & Merryweather Co....124
New Britain Machine Co....106
Newark Gear Cutting Machine Co. 98
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Schuchardt & Schütte..25, 93, 120
Sloan & Chace Mfg. Co..... 42
Waltham Machine Works..... 85
Whiton Machine Co., D. E....120

Gear Testing Machinery
Gisholt Machine Co..... 85
Morse Twist Drill & Mach. Co. 59

Gears, Cut
Adams Co..... 98
American Vanadium Co.....106
Bilgram Machine Works..... 97
Boston Gear Works..... 96
Brown & Sharpe Mfg. Co..55, 132
Caldwell & Sons Co., H. W... 97
Carpenter-Tew Gear Co..... 96
Chicago Rawhide Mfg. Co.... 99
Cincinnati Gear Co..... 96
Clough, R. M..... 97
Earle Gear & Machine Co.... 97
Fawcus Machine Co..... 96
Fellows Gear Shaper Co..... 24
Flather Mfg. Co., E. J..... 98
Foote Bros. Gear & Mach. Co. 98
Garvin Machine Co.....77, 118
Gould & Eberhardt..... 15
Grant Gear Works..... 96
Harrington, Son & Co., Edwin. 123
Horsburgh & Scott Co..... 98
Link-Belt Co..... 75
Meisel Press & Mfg. Co..... 98
Meisselbach-Catucci Mfg. Co.. 97
New Process Rawhide Co..... 98
Newark Gear Cutting Machine Co. 98
Nuttall Co., R. D..... 96
Philadelphia Gear Works..... 96
Poole Engr. & Mach. Co..... 97
Sawyer Gear Works..... 96
Simonds Mfg. Co., The..... 97
Taylor-Wilson Mfg. Co..... 97
Toledo Bridge & Crane Co.... 122

Gears, Molded
Caldwell & Sons Co., H. W... 97
Doehler Die Casting Co.....101
Franklin Mfg. Co.....104
Horsburgh & Scott Co..... 98
Link-Belt Co..... 75
Philadelphia Gear Works..... 96
Poole Engr. & Mach. Co..... 97
Precision Die-Casting Co.....102
Taylor-Wilson Mfg. Co..... 97

Gears, Rawhide
Boston Gear Works..... 96
Chicago Rawhide Mfg. Co.... 99
Earle Gear & Mach. Co..... 97
Foote Bros. Gear & Mach. Co. 98
Gould & Eberhardt..... 15
Grant Gear Works..... 96
Horsburgh & Scott Co..... 98
New Process Rawhide Co.... 98
Nuttall Co., R. D..... 96
Philadelphia Gear Works.... 96
Sawyer Gear Works..... 96

Gears, Worm
Albro-Clem Elevator Co., The. 96
Boston Gear Works..... 96
Brown & Sharpe Mfg. Co..55, 132
Carpenter-Tew Gear Co..... 96
Cincinnati Gear Co..... 96
Earle Gear & Machine Co.... 97
Fawcus Machine Co..... 96
Foote Bros. Gear & Mach. Co. 98
Gould & Eberhardt..... 15
Horsburgh & Scott Co..... 98
Link-Belt Co..... 75
Newark Gear Cutting Machine Co. 98
Nuttall Co., R. D..... 96
Philadelphia Gear Works.... 96
Taylor-Wilson Mfg. Co..... 97

Generating Sets
Burke Electric Co.....116
General Electric Co.....114
Richmond Electric Co.....116
Sprague Electric Works.....115
Triumph Electric Co.....115
Westinghouse Elec. & Mfg. Co. 115

Generators, Gas
American Gas Furnace Co....102
Sowers Mfg. Co.....107

Graphite
Dixon Crucible Co., Jos.....108

Grinders, Bench
Athol Machine Co..... 87
Chicago Pneumatic Tool Co.. 94
Diamond Machine Co..... 80
Modern Tool Co.....113
Pratt & Whitney Co..... 47
U. S. Electrical Tool Co.....121
Walker & Co., O. S.....132

Grinders, Center
Coates Clipper Mfg. Co.....117
Diamond Machine Co..... 80
Gem Mfg. Co.....112
Greenfield Machine Co.....112
Mueller Machine Tool Co..... 90
Niles-Bement-Pond Co....2, 3, 46
Trump Bros. Mach. Co.....120
U. S. Electrical Tool Co.....121

Grinders, Chucking
Bryant Chucking Grinder Co. 42
Pratt & Whitney Co..... 47

Grinders, Cutlery
Hemming Bros. Co..... 99

Grinders, Cutter
Bath Grinder Co..... 65
Becker Milling Machine Co... 23
Blake & Johnson Co.....112
Brown & Sharpe Mfg. Co..55, 132
Carpenter-Tew Gear Co..... 96
Cincinnati Milling Mach. Co..6, 7
Garrigus Machine Co., C. G..111
Gould & Eberhardt..... 15
Greenfield Machine Co.....112
Heald Machine Co..... 31
Ingersoll Milling Mach. Co... 14
LeBlond Mach. Tool Co., R. K. 63, 132
Leland & Co., W. H..... 89
Modern Tool Co.....113
Niles-Bement-Pond Co....2, 3, 46
Norton Grinding Co..... 68
Oesterlein Machine Co..... 28
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...121
Rivett Lathe Mfg. Co.....131
U. S. Electrical Tool Co.....121
Wells & Son Co., F. E..... 85
Wilmarth & Morman Co.....113

Grinders, Cylindrical
Bath Grinder Co..... 65
Brown & Sharpe Mfg. Co..55, 132
Diamond Machine Co..... 80
Greenfield Machine Co.....112
Heald Machine Co..... 31
Landis Tool Co..... 57
Leland & Co., W. H..... 89
Modern Tool Co.....113
Morse Twist Drill & Mach. Co. 59
Norton Grinding Co..... 68
Pratt & Whitney Co..... 47
U. S. Electrical Tool Co.....121

Grinders, Disc
Bath Grinder Co..... 65
Besly & Co., Chas. H.....127
Diamond Machine Co..... 80
Gardner Machine Co.....111
Garrigus Machine Co., C. G..111
Ransom Mfg. Co.....113
Rowbottom Machine Co.....112
Safety Emery Wheel Co.....111
Taylor & Fenn Co.....113

Grinders, Drill
Heald Machine Co..... 31
Morse Twist Drill & Mach. Co. 59
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Safety Emery Wheel Co.....111
Sellers & Co., Wm..... 40
Standard Tool Co..... 26
U. S. Electrical Tool Co.....121
Washburn Shops.....112
Wilmarth & Morman Co.....113

Grinders, Internal
Bath Grinder Co..... 65
Brown & Sharpe Mfg. Co..55, 132
Diamond Machine Co..... 80
Grant Mfg. & Mach. Co..... 82
Greenfield Machine Co.....112
Heald Machine Co..... 31
Landis Tool Co..... 57
Leland & Co., W. H..... 89
Modern Tool Co.....113
Pratt & Whitney Co..... 47
Rivett Lathe Mfg. Co.....131
U. S. Electrical Tool Co.....121

Grinders, Knife
Safety Emery Wheel Co.....111

Grinders, Plain
Garrigus Machine Co., C. G..111
La Salle Machine Tool Co....112
Modern Tool Co.....113

Grinders, Portable
Chicago Pneumatic Tool Co.. 94
Coates Clipper Mfg. Co.....117
U. S. Electrical Tool Co.....121

Grinders, Saw
Tindel-Morris Co..... 98

Grinders, Surface
Blanchard Machine Co....77, 90
Garrigus Machine Co., C. G..111
Garvin Machine Co.....77, 118
Heald Machine Co..... 31
Hemming Bros. Co..... 99
La Salle Machine Tool Co....112
Leland & Co., W. H..... 89
Pratt & Whitney Co..... 47
Rowbottom Machine Co.....112
U. S. Electrical Tool Co.....121

Grinding Talks

In Thirteen Weekly Chapters

Number Two

Grinding Wheel Speeds

For the grinding wheel, 5000 feet per minute is a safe peripheral speed.

To determine the wheel speed in feet, multiply the diameter of the wheel in inches by 3.14, and the result by the number of revolutions per minute, and divide by 12.

By revolving the work, and not the wheel, it will be seen that the metal wears into the wheel or gouges it, but by rotating the wheel and increasing its speed, it will be noticed that the faster the wheel revolves the ess noticeable the wear, and this increases until there is no apparent wear on the wheel, hence, increasing the speed of the wheel decreases its wear, and conversely, decreasing the speed increases the wear.

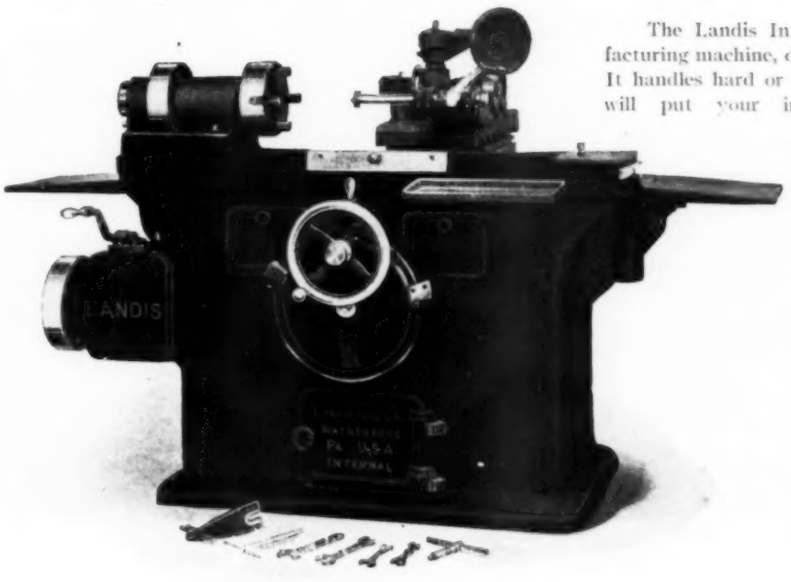
Reducing the work speed decreases the wear on the wheel so that to eliminate all excessive wear it is necessary to consider both the speed of the wheel and the speed of the work.

It also follows that, as the size of the wheel decreases, it is necessary to increase the number of revolutions, so as to maintain a constant peripheral speed.

Physics teaches that the centrifugal forces of bodies moving in the circular direction increase proportionately as the squares of their velocities; as an example a wheel running at a speed of 6000 feet per minute has 44% more internal strains than the same wheel running at 5000 feet per minute. In no case should a wheel exceed the speed designated by the wheel maker, which generally is in excess of the usual requirements. Before placing the wheel on the machine, tap it gently with a hammer and note the ring. If it is not clear it is cracked, and unsafe.

Next Week—"Work And Traverse Speeds"

Internal Grinding On The Landis Means Accuracy—Economy—Profit



The Landis Internal Grinding Machine is a manufacturing machine, designed for straight or taper grinding. It handles hard or soft material with equal facility and will put your internal grinding on a profitable basis, whether the work is produced in large or small quantities.

Note the following advantages:

The design is such that vibration is eliminated. Provision can be made for using water. On duplicate work every hole can be ground to same size. Less care is necessary when boring. Reaming unnecessary. No lapping required. Round, straight and uniform hole assured. Varied work handled as easily as duplicate parts.

Write for further details. Will be glad to furnish literature covering the machine and its features, which gives full description with illustrations.

Landis Tool Company, Waynesboro, Pa.

Grinders, Tool

Armstrong Bros. Tool Co.... 86
Barnes Co., W. F. & John.... 33
Bath Grinder Co..... 65
Blake & Johnson Co.....112
Blount Co., J. G.....111
Brown & Sharpe Mfg. Co..55, 132
Cincinnati Milling Mach. Co..6, 7
Diamond Mach. Co..... 80
Garrigus Machine Co., C. G..111
Gisholt Machine Co..... 85
Gould & Eberhardt..... 15
Grant Mfg. & Mach. Co..... 82
Greenfield Machine Co.....112
Landis Tool Co..... 57
La Salle Machine Tool Co....112
LeBlond Mach. Tool Co., R. K.. 63, 132
Leland & Co., W. H..... 89
McCabe, J. J.....84, 124
Modern Tool Co.....113
Morse Twist Drill & Mach. Co. 59
Newark Gear Cutting Machine Co. 98
Niles-Bement-Pond Co....2, 3, 46
Norton Grinding Co..... 68
Oesterlein Machine Co..... 28
Pratt & Whitney Co..... 47
Ransom Mfg. Co.....113
Rivett Lathe Mfg. Co.....131
Rockford Drilling Mach. Co...127
Rowbottom Machine Co.....112
Safety Emery Wheel Co.....111
Sellers & Co., Wm..... 40
Standard Tool Co..... 26
U. S. Electrical Tool Co.....121
Vandyck Churchill Co..... 98
Vitrified Wheel Co.....111
Walker & Co., O. S.....132
Wells & Son Co., F. E..... 85
Whitney Mfg. Co..... 53
Wilmarth & Morman Co.....113

Grinding or Polishing Machines

Abbott Ball Co.....121
American Emery Wheel Wks.111
Barnes Co., W. F. & John.... 33
Bath Grinder Co..... 65
Besly & Co., Chas. H.....127
Blake & Johnson Co.....117
Blanchard Machine Co....77, 90
Blount Co., J. G.....111
Brown & Sharpe Mfg. Co..55, 132
Bryant Chucking Grinder Co.. 42
Chicago Pneumatic Tool Co... 94
Coates Clipper Mfg. Co.....117
Diamond Machine Co..... 80
Gardner Machine Co.....111
Garrigus Machine Co., C. G..111
Grant Mfg. & Mach. Co..... 82
Greenfield Machine Co.....112
Harrington, Son & Co., Edwin.123
Heald Machine Co..... 31
Hemming Bros. Co..... 99
Holtzer-Cabot Electric Co....116
Landis Tool Co..... 57
Leland & Co., W. H..... 89
McCabe, J. J.....84, 124
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Norton Grinding Co..... 68
Ransom Mfg. Co.....113
Rivett Lathe Mfg. Co.....131
Rowbottom Machine Co.....112
Safety Emery Wheel Co.....111
Sterling Emery Wheel Mfg. Co.113
U. S. Electrical Tool Co.....121
Vitrified Wheel Co.....111
Wells & Son Co., F. E..... 85

Grinding Wheels

American Emery Wheel Wks.111
Carborundum Co..... 39
Coates Clipper Mfg. Co.....117
Diamond Machine Co..... 80
Dickinson, Thos. I..... 50
Niles-Bement-Pond Co....2, 3, 46
Norton Co..... 69
Safety Emery Wheel Co.....111
Sterling Emery Wheel Mfg. Co.113
Vitrified Wheel Co.....111
Whitney Mfg. Co..... 53

Grindstones and Frames

Brown & Sharpe Mfg. Co..55, 132
Niles-Bement-Pond Co....2, 3, 46
Norton Co..... 69
Sterling Emery Wheel Mfg. Co.113
Whitman & Barnes Mfg. Co.. 91

Gun Barrel Machinery

Diamond Machine Co..... 80
Pratt & Whitney Co..... 47
Reed Co., F. E..... 45

Hammers, Air

Nazel Engr. Machine Works.. 88

Hammers, Belt Driven

Nazel Engr. Machine Works.. 88
Prentiss Tool & Supply Co...124

Hammers, Drop

Billings & Spencer Co.....117
Bliss Co., E. W..... 59
Bradley & Son, C. C..... 88
Gould & Eberhardt..... 15
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co....124

Hammers, Drop—*Continued.*

Toledo Mach. & Tool Co..... 88
Waterbury Farrel Fdry. and Mach. Co..... 50

Hammers, Pneumatic

Bliss Co., E. W..... 59
Chicago Pneumatic Tool Co.. 94
Dallett Co., Thos. H..... 95
Independent Pneu. Tool Co.... 95
Ingersoll-Rand Co..... 95
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40

Hammers, Power

Bradley & Son, C. C..... 88

Hammers, Steam

Bradley & Son, C. C..... 88
Chambersburg Engineering Co. 91
Manning, Maxwell & Moore...128
Marshall & Huschart Machry. Co. 125
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40
Vandyck Churchill Co..... 98

Handles

Osgood, J. I..... 93
Western Tool & Mfg. Co..... 99

Hangers, Shafting

Brown & Sharpe Mfg. Co..55, 132
Hyatt Roller Bearing Co..... 86
Niles-Bement-Pond Co....2, 3, 46
Royersford Fdry. & Mach. Co. 90
Sellers & Co., Wm..... 40

Hard Fiber Specialties

Delaware Hard Fibre Co....121

Hardening and Tempering

General Electric Co.....114
Worcester Pressed Steel Co...115

Hobbing Machines, Gear

New Britain Machine Co....106

Hobbing Machines, Worm

Adams Co..... 98
Brown & Sharpe Mfg. Co..55, 132
Meisselbach-Catucci Mfg. Co.. 97
Newark Gear Cutting Machine Co. 98
Newton Machine Tool Wks... 19
Pratt & Whitney Co..... 47
Schuchardt & Schütte..25, 93, 120

Hoisting and Conveying Machinery

Caldwell & Sons Co., H. W... 97
Link-Belt Co. 75
Niles-Bement-Pond Co....2, 3, 46
United Engr. & Fdry. Co.... 88
Yale & Towne Mfg. Co.....123

Hoists, Electric

General Electric Co.....114
Maris Bros. 122
Niles-Bement-Pond Co....2, 3, 46
Northern Engineering Wks. .122
Shaw Electric Crane Co.....122
Shepard Electric Crane and Hoist Co.....123
Sprague Electric Works.....115
Westinghouse Elec. & Mfg. Co.115
Yale & Towne Mfg. Co.....123

Hoists, Hand

Harrington, Son & Co., Edwin.123
Moore Co., Franklin.....122
Niles-Bement-Pond Co....2, 3, 46
Yale & Towne Mfg. Co.....123

Hoists, Pneumatic

Chicago Pneumatic Tool Co.. 94
Independent Pneu. Tool Co... 95
Ingersoll-Rand Co..... 95
Northern Engineering Wks...122
Shepard Electric Crane and Hoist Co.....123

Hones

Carborundum Co..... 39

Hose

Chicago Pneumatic Tool Co.. 94
Sprague Electric Works.....115

Igniters, Gas Engine

Doehler Die Casting Co.....101
Franklin Mfg. Co.....104

Indexing Machines

Springfield Machine Tool Co.. 49

Indicators, Speed

Brown Instrument Co.....117
Brown & Sharpe Mfg. Co..55, 132
Grant Mfg. & Mach. Co..... 82
Starrett Co., L. S..... 72
Veeder Mfg. Co..... 93

Indicators, Test

Brown & Sharpe Mfg. Co..55, 132
Norton Grinding Co..... 68
Starrett Co., L. S..... 72

Injectors

Sellers & Co., Wm..... 40

Instruments, Steel Hardness Measuring

Shore Instrument & Mfg. Co..107

Iron Bar

Milton Mfg. Co..... 81

Jacks, Hydraulic

Elmes Engineering Works, Chas. F..... 91
Watson-Stillman Co..... 95

Jacks, Planer

Armstrong Bros. Tool Co..... 86

Jigs and Fixtures

Columbus Die, Tool & Mach. Co. 109
Grant Mfg. & Machine Co..... 82
Taft-Peirce Mfg. Co.....128

Kettles, Soda

Brown & Sharpe Mfg. Co..55, 132
Manufacturing Equipment and Engineering Co..... 82

Key Seaters

Baker Bros. 86
Davis Machine Co., W. P..... 74
Lapointe Co., J. N..... 86
Lapointe Mach. Tool Co..... 43
Marshall & Huschart Machry. Co. 125
Mitts & Merrill..... 88
Morton Manufacturing Co.... 116
Niles-Bement-Pond Co....2, 3, 46
Rockford Drilling Mach. Co..127

Keys, Machine

Morse Twist Drill & Mach. Co. 59
Standard Gauge Steel Co.....108
Whitney Mfg. Co., The..... 53

Knives, Machine

Coes Wrench Co..... 32
Disston & Sons, Inc., Henry.. 69
Simonds Mfg. Co..... 99

Knurl Holder

Graham Mfg. Co..... 87
Pratt & Whitney Co..... 47

Lamps, Arc

General Electric Co.....114
Westinghouse Elec. & Mfg. Co.115

Lathe Attachments

American Tool Works Co..... 8
Bradford Mach. Tool Co..... 5
Diamond Machine Co..... 80
Flather & Co., Inc..... 83
LeBlond Mach. Tool Co., R. K.. 63, 132
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Rivett Lathe Mfg. Co.....131
Sebastian Lathe Co..... 81
Seneca Falls Mfg. Co..... 80
Sloan & Chace Mfg. Co..... 42

Lathe Dogs

Armstrong Bros. Tool Co.... 86
Besly & Co., Chas. H.....127
Billings & Spencer Co.....117
Hammacher, Schlemmer & Co. 65
Johnson Jr. & Co., I. H..... 85
Pratt & Whitney Co..... 47
Springfield Mach. Tool Co.... 49
Tindel-Morris Co..... 98
Western Tool & Mfg. Co..... 99
West Steel Casting Co.....109
Williams & Co., J. H..... 78

Lathe Tools

Western Tool & Mfg. Co..... 99

Lathes

Acme Machine Tool Co..... 34
American Tool Works Co.... 8
Automatic Machine Co..... 61
Barnes Co., W. F. & John.... 33
Barnes Drill Co..... 89
Blount Co., J. G.....111
Bradford Mach. Tool Co..... 5
Bullard Machine Tool Co..70, 71
Carter & Hakes Machine Co.. 87
Champion Tool Works Co.... 84
Cincinnati Lathe & Tool Co.. 85
Davis Machine Co., W. P.... 74
Detrick & Harvey Mach. Co..121
Diamond Machine Co..... 80
Dreses Machine Tool Co..... 22
Flather & Co., Inc..... 83
Flather Mfg. Co., E. J..... 98
Gisholt Machine Co..... 85
Greaves, Klusman & Co..... 85
Harrington, Son & Co., Edwin.123
Hendey Machine Co..... 61
Johnson Jr. & Co., I. H..... 85
LeBlond Mach. Tool Co., R. K.. 63, 132
Lodge & Shipley Mach. Tool Co. 4, 16
Manning, Maxwell & Moore...128
Marshall & Huschart Machry. Co. 125
McCabe, J. J.....84, 124
Milwaukee Mach. Tool Co.... 87
Morris Mach. Tool Co., J. B. 85
Motch & Merryweather Mchry. Co. 124

Lathes—*Continued.*

New Haven Mfg. Co..... 93
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Prentice Bros. Co..... 29
Prentiss Tool & Supply Co...124
Reed Co., F. E..... 45
Rockford Drilling Mach. Co..127
Schumacher & Boye..... 22
Sebastian Lathe Co..... 84
Sellers & Co., Wm..... 40
Seneca Falls Mfg. Co..... 80
Springfield Mach. Tool Co.... 49
Tindel-Morris Co..... 98
Toomey, Frank.....125
Vandyck Churchill Co..... 98
Von Wyck Mach. Tool Co.... 87
Wells & Son Co., F. E..... 85
Windsor Machine Co..... 38
Wormer Mchry. Co., C. C....125

Lathes, Automatic Screw Threading

Automatic Machine Co..... 61
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...124

Lathes, Bench

Ames Co., B. C..... 93
Blount Co., J. G.....111
Diamond Machine Co..... 80
Pratt & Whitney Co..... 47
Rivett Lathe Mfg. Co.....131
Sebastian Lathe Co..... 84
Seneca Falls Mfg. Co..... 80
Sloan & Chace Mfg. Co..... 42
Stark Tool Co..... 85
Taylor & Fenn Co.....113
Waltham Machine Works..... 85
Waltham Watch Tool Co.....125
Wells & Son Co., F. E..... 85

Lathes, Boring

Harrington, Son & Co., Edwin.123
Johnson Jr. & Co., I. H..... 85
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Inc., Wm..... 40

Lathes, Brass

Acme Machine Tool Co..... 34
Dreses Mach. Tool Co..... 22
Johnson Jr. & Co., I. H..... 85
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Springfield Mach. Tool Co... 49
Warner & Swasey Co.. 44

Lathes, Chucking

Jones & Lamson Machine Co.. 12, 13, 50
Niles Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47

Lathes, Extension

Barnes Drill Co..... 89
Harrington, Son & Co., Edwin.123
Johnson Jr. & Co., I. H..... 85
Niles-Bement-Pond Co....2, 3, 46

Lathes, Foot Power

Barnes Co., W. F. & John.... 33
Niles-Bement-Pond Co....2, 3, 46
Sebastian Lathe Co..... 84
Seneca Falls Mfg. Co..... 80

Lathes, Gap

American Tool Wks. Co..... 8
Barnes Drill Co..... 89
Harrington, Son & Co., Edwin.123
Sebastian Lathe Co..... 84
Sellers & Co., Wm..... 40

Lathes, Horizontal Turret

Flather & Co., Inc..... 83
Garvin Machine Co.....77, 118
Gisholt Machine Co..... 85
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Warner & Swasey Co..... 44
Washburn Shops.....112

Lathes, Speed

Blount Co., J. G.....111
Grant Mfg. & Mach. Co..... 82
Diamond Machine Co..... 80
LeBlond Mach. Tool Co., R. K.. 63, 132
Marshall & Huschart Machry. Co. 125
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Sebastian Lathe Co..... 84
Seneca Falls Mfg. Co..... 80
Wells & Son Co., F. E..... 85

Lathes, Vertical Turret

Bullard Machine Tool Co..70, 71

Lathes, Wood

Barnes Co., W. F. & John.... 33
Seneca Falls Mfg. Co..... 80

Levels

Starrett Co., L. S..... 72

Lockers, Clothes

Hart & Cooley Co..... 78
Manufacturing Equipment and Engineering Co..... 82

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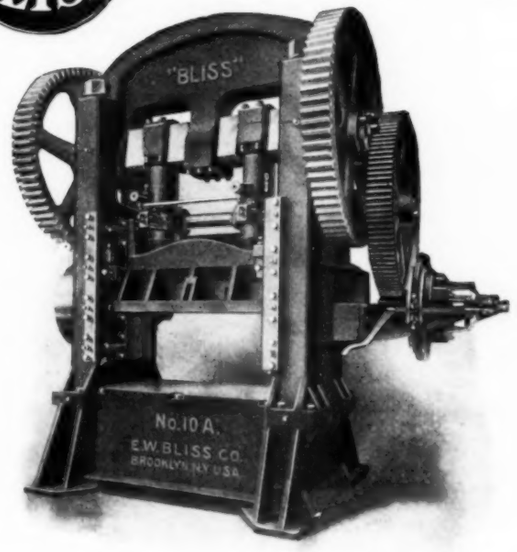

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Besly & Co., Chas. H.....127
Gem Mfg. Co.....112
Royersford Fdry. & Mach. Co. 90
White & Bagley Co.....117

Machinery Dealers
Besly & Co., Chas. H.....127
Garvin Machine Co.....77, 118
Manning, Maxwell & Moore...128
Marshall & Huschart Mchry. Co. 125
McCabe, J. J.....84, 124
Motch & Merryweather Co. 124
Niles-Bement-Pond Co....2, 3, 46
Osgood, J. I.....93
Prentiss Tool & Supply Co...124
Schuchardt & Schütte..25, 93, 120
Toomey, Frank.....125
Vandyck Churchill Co.....98
Wormer Mchry. Co., C. C....125

Machinists' Small Tools
Athol Machine Co.....87
Bemis & Call Hardware and Tool Co.....86
Besly & Co., Chas. H.....127
Billings & Spencer Co.....117
Boker & Co., Hermann.....73
Brown & Sharpe Mfg. Co..55, 132
Cleveland Twist Drill Co....132
Diamond Saw & Stamping Wks. 99
Garvin Machine Co.....77, 118
Hammacher, Schlemmer & Co. 65
Millers Falls Co.....98
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47
Schuchardt & Schütte..25, 93, 120
Slocomb Co., J. T.....90
Standard Tool Co.....26
Starrett Co., L. S.....72
Whitman & Barnes Mfg. Co...91
Williams & Co., J. H.....78

Machinists' Supplies
Bemis & Call Hardware & Tool Co. 86
Besly & Co., Chas. H.....127
Diamond Saw & Stamping Wks. 99
Garvin Machine Co.....77, 118
Hammacher, Schlemmer & Co. 65
McCabe, J. J.....84, 124
Osgood, J. I.....93
Schuchardt & Schütte..25, 93, 120
Whitman & Barnes Mfg. Co.. 91

Mandrels, Expanding
Celfor Tool Co.....89
Morse Twist Drill & Mach. Co. 59
Nicholson & Co., W. H.....121
Pratt & Whitney Co.....47
Western Tool & Mfg. Co.....99
Whitman & Barnes Mfg. Co.. 91

Mandrels, Solid
Brown & Sharpe Mfg. Co..55, 132
Cleveland Twist Drill Co....132
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co.....47
Standard Tool Co.....26

Measuring Machines
Pratt & Whitney Co.....47

Metal, Bearings
Atkinson Co. 105
Besly & Co., Chas. H.....127
Lumen Bearing Co.....104
Phosphor Bronze Smelting Co.102

Micrometer Calipers
Brown & Sharpe Mfg. Co..55, 132
Slocomb Co., J. T.....90
Starrett Co., L. S.....72

Milling Attachments
Adams Co.....98
Becker Milling Machine Co....23
Brown & Sharpe Mfg. Co..55, 132
Cincinnati Milling Mach. Co..6, 7
Garvin Machine Co.....77, 118
Ingersoll Milling Mach. Co....14
Kearney & Trecker Co.....26
Kempsmith Mfg. Co.....27
LeBlond Mach. Tool Co., R. K., 63, 132
Niles-Bement-Pond Co....2, 3, 46
Oesterlein Machine Co.....28
Pratt & Whitney Co.....47
Rivett Lathe Mfg. Co.....131
Underwood Co., H. B.....92
Whitney Mfg. Co.....53

Milling Machines, Bench
Ames Co., B. C.....93
Carter & Hakes Machine Co.. 87
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47
Rivett Lathe Mfg. Co.....131
Sloan & Chace Mfg. Co.....42
Stark Tool Co.....85
Waltham Watch Tool Co.....125

Milling Machines, Hand
Adams Co.....98
Becker Milling Machine Co...23
Brown & Sharpe Mfg. Co..55, 132
Carter & Hakes Machine Co.. 87
Cincinnati Milling Mach. Co..6, 7
Garvin Machine Co.....77, 118
Pratt & Whitney Co.....47
Prentiss Tool & Supply Co...124
Whitney Mfg. Co.....53

Milling Machines, Horizontal
Adams Co.....98
Beaman & Smith Co.....25, 118
Becker Milling Machine Co....23
Brown & Sharpe Mfg. Co..55, 132
Cincinnati Milling Mach. Co..6, 7
Garvin Machine Co.....77, 118
Hendey Machine Co.....61
Ingersoll Milling Mach. Co....14
Kempsmith Mfg. Co.....27
Newton Machine Tool Wks...19
Niles-Bement-Pond Co....2, 3, 46
Oesterlein Machine Co.....28
Pratt & Whitney Co.....47
Rochester Boring Machine Co.125
Sellers & Co., Wm.....40
Universal Boring Machine Co.113
Whitney Mfg. Co.....53

Milling Machines, Plain
Adams Co.....98
American Tool Works Co....8
Beaman & Smith Co.....25, 118
Becker Milling Machine Co....23
Brown & Sharpe Mfg. Co..55, 132
Carter & Hakes Mach. Co.....87
Cincinnati Milling Mach. Co..6, 7
Garvin Machine Co.....77, 118
Hendey Machine Co.....61
Ingersoll Milling Mach. Co....14
Kearney & Trecker Co.....26
Kempsmith Mfg. Co.....27
LeBlond Mach. Tool Co., R. K., 63, 132
Manning, Maxwell & Moore...128
Marshall & Huschart Machry. Co. 125
McCabe, J. J.....84, 124
Morton Mfg. Co.....116
Motch & Merryweather Machinery Co.....124
Newton Machine Tool Wks...19
Niles-Bement-Pond Co....2, 3, 46
Oesterlein Machine Co.....28
Pratt & Whitney Co.....47
Vandyck Churchill Co.....98
Waltham Watch Tool Co....125
Warner & Swasey Co.....44
Whitney Mfg. Co.....53
Wormer Mchry. Co., C. C....125

Milling Machines, Portable
Newton Machine Tool Wks...19
Niles-Bement-Pond Co....2, 3, 46

Milling Machines, Universal
American Tool Wks. Co.....8
Becker Milling Machine Co....23
Brown & Sharpe Mfg. Co..55, 132
Cincinnati Milling Mach. Co..6, 7
Garvin Machine Co.....77, 118
Hendey Machine Co.....61
Kearney & Trecker Co.....26
Kempsmith Mfg. Co.....27
LeBlond Mach. Tool Co., R. K., 63, 132
Manning, Maxwell & Moore...128
Marshall & Huschart Machine Co. 125
McCabe, J. J.....84, 124
Motch & Merryweather Machinery Co.....124
Newton Machine Tool Wks...19
Niles-Bement-Pond Co....2, 3, 46
Oesterlein Machine Co.....28
Waltham Watch Tool Co.....125

Milling Machines, Vertical
Adams Co.....98
Beaman & Smith Co.....25, 118
Becker Milling Machine Co....23
Brown & Sharpe Mfg. Co..55, 132
Carter & Hakes Machine Co.. 87
Cincinnati Milling Mach. Co..6, 7
Clough, R. M.....97
Garvin Machine Co.....77, 118
Ingersoll Milling Mach. Co....14
Marshall & Huschart Machry. Co. 125
Newton Machine Tool Wks...19
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm.....40
Vandyck Churchill Co.....98
Waltham Watch Tool Co.....125

Milling Machines, Worm
Cleveland Auto. Mach. Co....18
Pratt & Whitney Co.....47

Milling Tools, Adjustable
Geometric Tool Co.....34
Grant Mfg. & Machine Co....82

Mining Machinery
Ingersoll-Rand Co.....95

Molding Machines
Adams Co.....98

Motors, Electric
Burke Electric Co.....116
Contes Clipper Mfg. Co.....117
General Electric Co.....114
Holtzer-Cabot Electric Co....116
Reliance Elec. & Eng. Co....116
Richmond Electric Co.....116
Roth Bros. & Co.....116
Sprague Electric Works.....115
Triumph Electric Co.....115
Westinghouse Elec. & Mfg. Co.115

Name Plates
Franklin Mfg. Co.....104

Nippers and Pliers
Utica Drop Forge & Tool Co..116

Nut Tappers
See Bolt and Nut Machinery.

Nuts
Milton Mfg. Co.....81

Odometers
Veeder Mfg. Co.....93

Oil Cups and Covers
Bay State Stamping Co.....86
Besly & Co., Chas. H.....127
Doehler Die Casting Co.....101

Oilers
Gem Mfg. Co.....112

Oils
Besly & Co., Chas. H.....127
White & Bagley Co.....117

Packing, Hydraulic
Chicago Rawhide Mfg. Co.... 99

Packing, Steam
Smooth-On Mfg. Co.....107

Paints, Machinery
Glidden Varnish Co.....108

Pans, Lathe Shop
New Britain Machine Co.....106

Pattern Shop Tools and Machinery
Baker Bros. 86
Blount Co., J. G.....111
Colburn Machine Tool Co.... 79
Greaves, Klusman & Co.....85
Hammacher, Schlemmer & Co. 65
McCabe, J. J.....84, 124
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...124
Rowbottom Machine Co.....112
Seneca Falls Mfg. Co.....80

Phosphor Bronze
Lumen Bearing Co.....104
Phosphor Bronze Smelting Co.102

Pin Machinery
Baird Machine Co., The.....88

Pinion Cutters
Sloan & Chace Mfg. Co.....42
Stark Tool Co.....85

Pipe Bending Machines
Stoever Fdry. & Mfg. Co.....92

Pipe Cutting and Threading Machines
Bignall & Keeler Mfg. Co.....92
Curtis & Curtis Co.....91
Foote-Burt Co.....92
Landis Machine Co.....110
Niles-Bement-Pond Co....2, 3, 46
Saunders' Sons, D.....92
Standard Engineering Co.....92
Stoever Fdry. & Mfg. Co.....92
United Engineering & Fdry. Co. 88
Wiley & Russell Mfg. Co.....109

Pipe Fitters' Tools
Butterfield & Co.....110
Cleveland Twist Drill Co....132
Reed Mfg. Co.....87
Saunders' Sons, D.....92
Standard Tool Co.....26
Trimont Mfg. Co.....73
Wells & Son Co., F. E.....85
Williams & Co., J. H.....78

Pipe, Welded and Seamless
National Tube Co.....108

Planer Attachments
Cincinnati Planer Co.....35
Gray Co., G. A.....28
Niles-Bement-Pond Co....2, 3, 46
Reed Co., F. E.....45

Planer Tools
Armstrong Bros. Tool Co.....86

Planers
American Tool Works Co.....8
Betts Machine Co.....9
Cincinnati Planer Co.....35
Cleveland Planer Works.....78
Detrick & Harvey Mach. Co..121
Gray Co., G. A.....28

Planers—*Continued.*
Harrington, Son & Co., Edwin.123
Hendey Machine Co.....61
Manning, Maxwell & Moore...128
McCabe, J. J.....84, 124
Motch & Merryweather Machy. Co. 124
New Haven Mfg. Co.....83
Niles-Bement-Pond Co....2, 3, 46
Powell Machine Co.....37
Pratt & Whitney Co.....47
Prentiss Tool & Supply Co...124
Sellers & Co., Wm.....40
Toomey, Frank.....125
Vandyck Churchill Co.....98
Woodward & Powell Planer Co. 87
Wormer Mchry. Co., C. C....125

Planers, Parallel
Walker & Co., O. S.....132

Planers, Portable
Morton Manufacturing Co....116
Niles-Bement-Pond Co....2, 3, 46
Underwood Co., H. B.....92

Planers, Rotary
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm.....40
Tindel-Morris Co.....98
Underwood Co., H. B.....92

Plate Rolls
Niles-Bement-Pond Co....2, 3, 46
Taylor-Wilson Mfg. Co.....97

Precision Machinery
Pratt & Whitney Co.....47
Rivett Lathe Mfg. Co.....131
Sloan & Chace Mfg. Co.....42
Stark Tool Co.....85
Waltham Watch Tool Co.....125

Presses, Arch
Blake & Johnson Co.....112

Presses, Bench Straightening
Springfield Machine Tool Co.. 49

Presses, Broaching
Bliss Co., E. W.....59
Prentiss Tool & Supply Co...124
Watson Stillman Co.....95

Presses, Drop
Bliss Co., E. W.....59
Niles-Bement-Pond Co....2, 3, 46
Toledo Machine & Tool Co....88
Waterbury Farrel Fdry. and Mach. Co.....50

Presses, Foot and Hand
Bliss Co., E. W.....59
Ferracute Machine Co.....91
Garrigus Machine Co., C. G..111
La Salle Machine Tool Co....112
Taylor & Fenn Co.....113
Waterbury Farrel Fdry. and Mach. Co.....50

Presses, Forging
Bliss Co., E. W.....59
Niles-Bement-Pond Co....2, 3, 46
United Engineering & Fdry. Co. 88

Presses, Hydraulic
Elmes Eng. Wks., Chas. F....91
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...124
Sellers & Co., Wm.....40
United Eng. & Fdry. Co.....88
Waterbury Farrel Fdry. and Mach. Co.....50
Watson-Stillman Co.....95

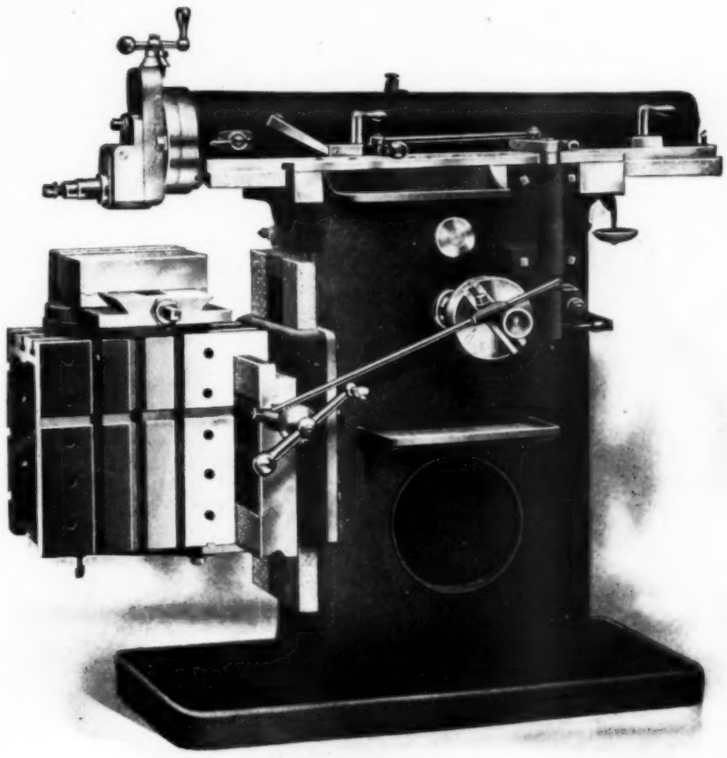
Presses, Pneumatic
Springfield Machine Tool Co.. 49

Presses, Power
Automatic Machine Co.....61
Baird Machine Co., The.....88
Billings & Spencer Co.....117
Blake & Johnson Co.....112
Bliss Co., E. W.....59
Dill Slotter People.....90
Ferracute Machine Co.....91
Garrigus Machine Co., C. G..111
La Salle Machine Tool Co....112
McCabe, J. J.....84, 124
Niagara Machine & Tool Wks. 90
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...124
Springfield Machine Tool Co.. 49
Toledo Machine & Tool Co....88
United Engineering & Fdry. Co. 88
Vandyck Churchill Co.....98
Waterbury Farrel Fdry. and Mach. Co.....50

Presses, Power Forcing
Barnes Co., W. F. & John....33
Lucas Machine Tool Co.....84

Presses, Screw
Barnes Co., W. F. & John....33
Bliss Co., E. W.....59

Presses, Sub
Blake & Johnson Co.....112



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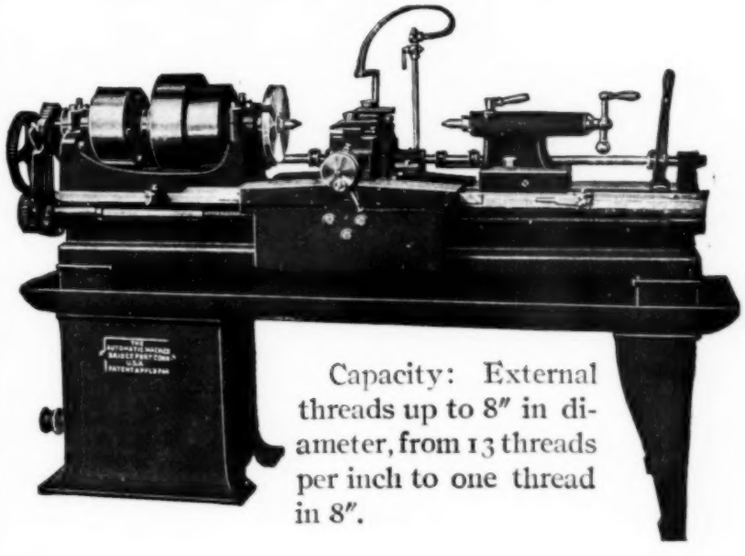

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Stark Tool Co..... 85

Publishers
McGraw-Hill Book Co..... 76

Pulley Turning and Boring Machines
American Tool Wks. Co..... 8
Harrington, Son & Co., Edwin. 123
New Haven Mfg. Co..... 83
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46

Pulleys
American Pulley Co.....123
Brown & Sharpe Mfg. Co..55, 132
Caldwell & Sons Co., H. W... 97
Link-Belt Co..... 75
New Haven Mfg. Co..... 83
Niles-Bement-Pond Co....2, 3, 46
Oneida Steel Pulley Co.....123
Rockwood Mfg. Co.....122
Sellers & Co., Wm..... 40
Taylor-Wilson Mfg. Co..... 97
Wilmarth & Morman Co.....113

Pulleys, Paper
Rockwood Mfg. Co.....122

Pumps, Electric
General Electric Co.....114

Pumps, Hydraulic
Elmes Eng. Works, Chas. F... 91
General Electric Co.....114
Watson-Stillman Co..... 95

Pumps, Pneumatic Steam
Ingersoll-Rand Co..... 95

Punches, Boiler
Simplex Tool & Supply Co....109

Punches, Centering
Brown & Sharpe Mfg. Co..55, 132
Hammacher, Schlemmer & Co. 65
Sellers & Co., Wm..... 40
Starrett Co., L. S..... 72

Punches, Hand
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40

Punches, Hydraulic
Elmes Eng. Works, Chas. F... 91
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co....124
Sellers & Co., Wm..... 40
United Eng. & Fdry. Co..... 88
Watson-Stillman Co..... 95

Punches, Power
Armstrong-Blum Mfg. Co..... 92
Bliss Co., E. W..... 59
Carpenter-Tew Gear Co..... 96
Covington Machine Co..... 92
Ferracute Machine Co..... 91
Hilles & Jones Co..... 82
Long & Allstatter Co..... 91
McCabe, J. J.....84, 124
Mitts & Merrill..... 88
Niles-Bement-Pond Co....2, 3, 46
Royersford Fdry. & Mach. Co. 90
Sellers & Co., Wm..... 40
United Eng. & Fdry. Co..... 88

Pyrometers, Electric
Bristol Co.....132
Brown Instrument Co..... 117
Hoskins Mfg. Co.....105, 107
Thwing Instrument Co..... 93

Rack Cutting Machines
Adams Co..... 98
Carpenter-Tew Gear Co..... 96
Fellows Gear Shaper Co..... 24
Flather Mfg. Co., E. J..... 98
Gould & Eberhardt..... 15
Horsburgh & Scott Co..... 98
LeBlond Mach. Tool Co., R. K., 63, 132
Niles-Bement-Pond Co....2, 3, 46
Reed Co., F. E..... 45
Schuchardt & Schütte..25, 93, 120
Sloan & Chace Mfg. Co..... 42

Racks, Cut
Boston Gear Works..... 96
Brown & Sharpe Mfg. Co..55, 132
Fellows Gear Shaper Co..... 24
Flather Mfg. Co., E. J..... 98
Horsburgh & Scott Co..... 98
LeBlond Mach. Tool Co., R. K., 63, 132
Newark Gear Cutting Machine Co..... 98
Nuttall Co., R. D..... 96
Philadelphia Gear Works..... 96
Simonds Mfg. Co., The..... 97
Standard Gauge Steel Co.....108
Taylor-Wilson Mfg. Co..... 97

Racks, Steel
Berger Mfg. Co.....104

Racks, Tool
Manufacturing Equipment and Engineering Co..... 82
New Britain Mach. Co.....106

Radiators, Japanning Oven
American Gas Furnace Co....102

Rawhide
Colonial Leather Co.....109

Reamer Holders, Floating
Colburn Machine Tool Co.... 79

Reamers
Boker & Co., Hermann..... 73
Butterfield & Co.....110
Card Mfg. Co., S. W..... 41
Carpenter Tap & Die Co., J. M.110
Cleveland Twist Drill Co....132
Clough, R. M..... 97
Detroit Twist Drill Co..... 89
Gisholt Machine Co..... 85
Lapointe Mach. Tool Co..... 43
Lincoln-Williams Twist Drill Co. 109
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Simplex Tool & Supply Co....109
Standard Tool Co..... 26
Ward & Son, Edgar T.....100
Western Tool & Mfg. Co..... 99
Whitman & Barnes Mfg. Co.. 91
Wiley & Russell Mfg. Co.....109

Reamers, Expanding
Pratt & Whitney Co..... 47

Reaming Stands
Skinner Chuck Co.....119

Recorders, Time
Calculagraph Co..... 93

Rheostats
General Electric Co.....114
Westinghouse Elec. & Mfg. Co.115

Rivet Making Machinery
Blake & Johnson Co.....112

Riveters, Hydraulic
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40

Riveters, Pneumatic
Bliss Co., E. W..... 59
Chicago Pneumatic Tool Co.. 94
Dallett Co., Thos. H..... 95
Independent Pneu. Tool Co... 95
Ingersoll-Rand Co..... 95
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40
Shepard Electric Crane & Hoist Co. 123

Riveters, Steam
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40

Riveting Machines
Adt & Son, John..... 99
Grant Mfg. & Mach. Co..... 82
Hemming Bros. Co..... 99
Long & Allstatter Co..... 91
National Machinery Co..... 91
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40
Shuster Co., F. B..... 99
Townsend Mfg. Co., H. P.....113

Rolling Mill Machinery
Blake & Johnson Co.....112
Dill Slotter People..... 90
Hilles & Jones Co..... 82
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40
United Eng. & Fdry. Co..... 88
Waterbury Farrel Fdry. and Mach. Co..... 50

Rules, Steel
Brown & Sharpe Mfg. Co..55, 132
Dill Slotter People..... 90
Hammacher, Schlemmer & Co. 65
Slocomb Co., J. T..... 90
Starrett Co., L. S..... 72

Sand Blast Apparatus
Betton, J. M..... 95
Chicago Pneumatic Tool Co... 94
Pangborn Co., Thos. W..... 95
Paxson Co., J. W.....108

Sand Shifting Machinery
Link-Belt Co..... 75

Saw Frames and Blades, Hack
Diamond Saw & Stamping Wks. 99
Disston & Sons, Inc., Henry... 69
Hammacher, Schlemmer & Co. 65
Millers Falls Co..... 98
Niles-Bement-Pond Co....2, 3, 46
Simonds Mfg. Co..... 99
Simplex Tool & Supply Co....109
Starrett Co., L. S..... 72
Thompson & Son Co., Henry G. 99
West Haven Mfg. Co..... 99

Saw Sharpening Machines
Newton Machine Tool Wks... 19

Sawing Machines, Metal
Billings & Spencer Co.....117
Diamond Saw & Stamping Wks. 99
Gorton Machine Co., Geo.... 90
Hoefer Mfg. Co..... 82
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Simonds Mfg. Co..... 99
Simplex Tool & Supply Co....109
Tindel-Morris Co..... 98
Union Twist Drill Co..... 67
United Eng. & Fdry. Co..... 88
Vandyck Churchill Co..... 98
West Haven Mfg. Co..... 99

Sawing Machines, Wood
Colburn Machine Tool Co.... 79
Greaves, Klusman & Co..... 85
Seneca Falls Mfg. Co..... 80

Saws, Circular Metal
Disston & Sons, Inc., Henry... 69
Simonds Mfg. Co..... 99

Saws, Metal Band
Disston & Sons, Inc., Henry... 69
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co....124
Simonds Mfg. Co..... 99
West Haven Mfg. Co..... 99

Saws, Power Hack
Armstrong-Blum Mfg. Co..... 92
Diamond Saw & Stamping Wks. 99
Disston & Sons, Inc., Henry... 69
Hoefer Mfg. Co..... 82
Massachusetts Saw Works....117
Millers Falls Co..... 98
Niles-Bement-Pond Co....2, 3, 46
Simplex Mfg. Co..... 98
Simplex Tool & Supply Co....109
Thompson & Son Co., Henry G. 99
West Haven Mfg. Co..... 99
Western Tool & Mfg. Co..... 99

Saws, Screw Slotting
Disston & Sons, Inc., Henry... 60
Simonds Mfg. Co..... 69

Scales
Brown & Sharpe Mfg. Co..55, 132

Scleroscope
Shore Instrument & Mfg. Co..107

Scraper Holders
Western Tool & Mfg. Co..... 99

Scrapers, Universal
Western Tool & Mfg. Co..... 99

Screens, Shaking
Link-Belt Co..... 75

Screw Machine Work
National-Acme Mfg. Co.....130
Rummel Machine Screw Co... 92

Screw Machinery, Wood and Lag
Baker Bros..... 86
Cook Co., Asa S..... 92

Screw Machines, Automatic
Brown & Sharpe Mfg. Co..55, 132
Cleveland Automatic Mach. Co. 18
Davenport Machine Tool Co.. 91
Dreses Mach. Tool Co..... 22
Johnson Jr. & Co., I. H..... 85
Marshall & Huschart Machry. Co. 125
National-Acme Mfg. Co.....130
New Britain Machine Co.....106
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co....124
Universal Machine Screw Co. 92
Windsor Machine Co..... 38

Screw Machines, Hand
Acme Machine Tool Co..... 34
Brown & Sharpe Mfg. Co..55, 132
Cleveland Automatic Mach. Co. 18
Garvin Machine Co.....77, 118
Grant Mfg. & Mach. Co..... 82
Jones & Lamson Mach. Co., 12, 13, 56
Potter & Johnston.....20, 21
Pratt & Whitney Co..... 47
Rivett Lathe Mfg. Co.....131
Warner & Swasey Co..... 44
Wells & Son Co., F. E..... 85
Windsor Machine Co..... 38

Screw Plates
American Tap & Die Co.....110
Besly & Co., Chas. H.....127
Butterfield & Co.....110
Card Mfg. Co., S. W..... 41
Carpenter Tap & Die Co., J. M.110
Holroyd & Co.....110
Morse Twist Drill & Mach. Co. 59
Smart Mfg. Co., A. J.....110
Wells Bros. Co.....110
Wiley & Russell Mfg. Co.....109

Screws, Cap and Set
Allen Mfg. Co., Inc., The.... 91
Electric Welding Products Co.,105

Screws, Cap and Set—*Cont.*
Hammacher, Schlemmer & Co. 65
National-Acme Mfg. Co.....130
Universal Machine Screw Co. 92
Worcester Mach. Screw Co... 92

Screws, Machine
Allen Mfg. Co., Inc., The.... 91
Barnes Co., Wallace.....109
Electric Welding Products Co..105
Hammacher, Schlemmer & Co. 65
National-Acme Mfg. Co.....130
Standard Gauge Steel Co.....108
Universal Machine Screw Co. 92
Worcester Machine Screw Co. 92

Second Hand Machinery
Davis Machine Co., W. P..... 74
Garvin Machine Co.....77, 118
Manning, Maxwell & Moore..128
Marshall & Huschart Machry. Co. 125
McCabe, J. J.....84, 124
Motch & Merryweather Machy. Co. 124
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co... 124
Seneca Falls Mfg. Co..... 80
Toomey, Frank..... 125
Western Electric Co.....123
Wormer Machry. Co., C. C.....125

Separators, Oil and Steam
Nicholson & Co., W. H.....121

Shafting
Ward & Sons, Edgar T.....100

Shapers
American Tool Works Co..... 8
Cincinnati Shaper Co..... 48
Davis Machine Co., W. P..... 74
Gould & Eberhardt..... 15
Hendey Machine Co..... 61
Kelly Co., R. A..... 90
Manning, Maxwell & Moore...128
Marshall & Huschart Machry. Co. 125
McCabe, J. J.....84, 124
Morton Manufacturing Co....116
Motch & Merryweather Machinery Co. 124
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Potter & Johnston.....20, 21
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co....124
Sellers & Co., Wm..... 40
Smith & Mills.....126
Springfield Mach. Tool Co.... 49
Vandyck Churchill Co..... 98

Shears, Power
Bliss Co., E. W..... 59
Covington Machine Co..... 92
Ferracute Machine Co..... 91
Hilles & Jones Co..... 82
Long & Allstatter Co..... 91
Mitts & Merrill..... 88
Niagara Mach. & Tool Wks.... 90
Niles-Bement-Pond Co....2, 3, 46
Royersford Fdry. & Mach. Co. 90
Sellers & Co., Wm..... 40
Toledo Mach. & Tool Co..... 88
United Eng. & Fdry. Co..... 88

Shears, Rotary
Bliss Co., E. W..... 59
Detrick & Harvey Mach. Co..121
United Eng. & Fdry. Co..... 88

Sheet Metal Working Machinery
Bliss Co., E. W..... 59
Ferracute Machine Co..... 91
La Salle Machine Tool Co....112
Niagara Mach. & Tool Wks.... 90
Toledo Mach. & Tool Co..... 88
Waterbury Farrel Fdry. and Mach. Co..... 50

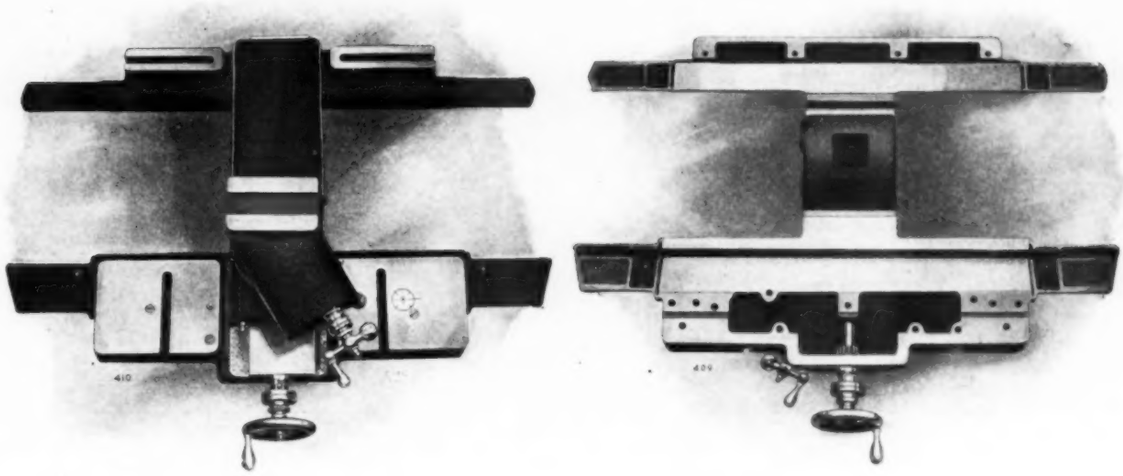
Slide Rests
Betts Machine Co..... 9
Blount Co., J. G.....111
Grant Mfg. & Mach. Co..... 82
National-Acme Mfg. Co.....130
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Reed Co., F. E..... 45

Slitters
Blake & Johnson Co.....112
La Salle Machine Tool Co....112

Slotters
Baker Bros..... 86
Betts Machine Co..... 9
Dill Slotter People..... 90
Garvin Machine Co.....77, 118
McCabe, J. J.....84, 124
New Haven Mfg. Co..... 83
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40
Tindel-Morris Co..... 98

Slotters, Auto Screw
Brown & Sharpe Mfg. Co..55, 132
Taylor & Fenn Co.....113

Slotters, Portable
Newton Machine Tool Wks... 19



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Cincinnati, Ohio

Sockets and Sleeves
Celfor Tool Co..... 89
Cleveland Twist Drill Co....132
Morse Twist Drill & Mach. Co. 59
Standard Tool Co..... 26
Union Twist Drill Co..... 67
Whitman & Barnes Mfg. Co.. 91

Special Machinery and Tools
Automatic Machine Co..... 61
Baird Machine Co., The..... 88
Beaman & Smith Co.....25, 118
Bilgram Machine Works..... 97
Blanchard Machine Co....77, 90
Bliss Co., E. W..... 59
Carter & Hakes Mach. Co.... 87
Cowdrey Mach. Wks., C. H...116
Dallett, Thos. H..... 95
Detroit Twist Drill Co..... 89
Earle Gear & Machine Co.... 97
Electric Welding Products Co.105
Garvin Machine Co.....77, 118
Grant Mfg. & Machine Co.... 82
Hoefer Mfg. Co..... 82
Hoggson & Pettis Mfg. Co....120
Horton Machine Co., S. E....118
Johnson Jr. & Co., I. H..... 85
Lucas Machine Tool Co..... 84
Manning, Maxwell & Moore...128
Merritt, Jos..... 50
Morrow Mfg. Co.....119
Mueller Mach. Tool Co..... 90
National Machinery Co..... 91
Nazel Engr. & Machine Wks.. 88
Niles-Bement-Pond Co....2, 3, 46
Poole Engr. & Machine Co.... 97
Pratt & Whitney Co..... 47
Rowbottom Machine Works..112
Sloan & Chace Mfg. Co..... 42
Sowers Mfg. Co.....107
Standard Engineering Co..... 92
Taft-Peirce Mfg. Co.....128
Taylor & Fenn Co.....113
Taylor-Wilson Co..... 97
Weeks, C. S..... 86
Wilkes-Barre Metal Drawing & Stamping Co. 105

Spiral Gear Cutting Machines
Pratt & Whitney Co..... 47

Springs
American Vanadium Co.....106
Barnes Co., Wallace.....109
Crucible Steel Co. of America.103

Sprockets and Chains
Baldwin Chain & Mfg. Co....126
Bilgram Machine Works..... 97
Boston Gear Works..... 96
Brown & Sharpe Mfg. Co..55, 132
Link-Belt Co..... 75
Philadelphia Gear Works..... 96

Stampings, Pressed Steel
Worcester Pressed Steel Co...103
Wilkes-Barre Metal Drawing & Stamping Co. 105

Stampings, Sheet Metal
Bay State Stamping Co..... 86
Worcester Pressed Steel Co...103

Stamps, Steel
Hoggson & Pettis Mfg. Co....120

Stands, Portable
Western Tool & Mfg. Co..... 99

Steam Specialties
Dart Mfg. Co., E. M..... 86
National Tube Co.....108

Steel, Air Hardening
Boker & Co., Hermann..... 73
Crucible Steel Co. of America.103
Drury Co., Limited, H. A....101
Firth-Sterling Steel Co.....100
Hawkridge Brothers Co.....105
Jessop & Sons, Inc., Wm.....108
Vanadium-Alloys Steel Co....106
Vulcan Crucible Steel Co.....105

Steel Hardness Measuring Instruments
Shore Instrument & Mfg. Co.107

Steel, Machinery
Boker & Co., Hermann..... 73
Crucible Steel Co. of America.103
Hawkridge Brothers Co.....105
Jessop & Sons, Inc., Wm.....108
Standard Gauge Steel Co.....108
Union Drawn Steel Co.....103
United Steel Co.....100
Vanadium-Alloys Steel Co....106
Vulcan Crucible Steel Co.....105
Ward & Son, Edgar T.....100

Steel, Sheet
Crucible Steel Co. of America.103
Disston & Sons, Inc., Henry.. 69
Drury Co., Limited, H. A....101
Firth-Sterling Steel Co.....100
Hawkridge Brothers Co.....105
Jessop & Sons, Inc., Wm.....108
Simonds Mfg. Co..... 99
Union Drawn Steel Co.....103
United Steel Co.....100

Steel, Sheet—*Continued.*
Vanadium-Alloys Steel Co....106
Vulcan Crucible Steel Co.....105
Ward & Son, Edgar T.....100

Steel, Tool
Boker & Co., Hermann..... 73
Crucible Steel Co. of America.103
Disston & Sons, Inc., Henry.. 69
Drury Co., Limited, H. A....101
Firth-Sterling Steel Co.....100
Hawkridge Brothers Co.....105
Jessop & Sons, Inc., Wm.....108
Standard Gauge Steel Co.....108
Union Drawn Steel Co.....103
Vanadium-Alloys Steel Co....106
Vulcan Crucible Steel Co.....105
Ward & Son, Edgar T.....100
Western Tool & Mfg. Co..... 99

Steel, Vanadium
Crucible Steel Co. of America.103
Firth Sterling Steel Co.....100
Hawkridge Brothers Co.....105
United Steel Co.....100
Vanadium-Alloys Steel Co....106
Vulcan Crucible Steel Co.....105

Stocks, Die
See Taps and Dies.

Stones, Oil
American Emery Wheel Wks. 111
Carborundum Co..... 39
Dickinson, Thos. L..... 50
Norton Co..... 69
Vitrified Wheel Co.....111

Stools, Shop
Manufacturing Equipment and Engineering Co..... 82
New Britain Machine Co.....106

Straighteners, Hydraulic
Niles-Bement-Pond Co....2, 3, 46

Straightening Machinery
Morse Twist Drill & Mach. Co. 59
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 40
Springfield Machine Tool Co.. 49
United Eng. & Fdry. Co..... 88

Strip Metal Straightening and Cutting Machine
Shuster Co., F. B..... 99

Swaging Machines
Excelsior Needle Co..... 92

Switchboards
General Electric Co.....114
Triumph Electric Co.....115
Westinghouse Elec. & Mfg. Co.115

Switches
General Electric Co.....114
Westinghouse Elec. & Mfg. Co.115

Tachometers
Veeder Mfg. Co..... 93

Tap Holders
Brown & Sharpe Mfg. Co..55, 132
Errington, F. A.....119
Modern Tool Co.....113
Warner & Swasey Co..... 44

Tapes, Measuring
Starrett Co., L. S..... 72

Tapping Machines and Attachments
American Tool Works Co..... 8
Baker Bros. 86
Beaman & Smith Co.....25, 118
Cincinnati Bickford Tool Co., 10, 11
Errington, F. A.....119
Fosdick Mach. Tool Co..... 32
Garvin Machine Co.....77, 118
Geometric Tool Co..... 34
Gould & Eberhardt..... 15
Grant Mfg. & Mach. Co..... 82
Modern Tool Co.....113
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...124
Rochester Boring Machine Co.125
Sloan & Chace Mfg. Co..... 42
Wells & Son Co., F. E..... 85
Whitney Mfg. Co..... 53

Taps and Dies
American Tap & Die Co.....110
Bay State Tap & Die Co.....110
Besly & Co., Chas. H.....127
Boker & Co., Hermann..... 73
Borden Co. 110
Brubaker & Bros., W. L.....110
Butterfield & Co.....110
Card Mfg. Co., S. W..... 41
Carpenter Tap & Die Co., J. M.110
Cleveland Twist Drill Co....132
Curtis & Curtis Co..... 91
Foote-Burt Co..... 92
Geometric Tool Co..... 34
Hammacher, Schlemmer & Co. 65
Holroyd & Co.....110
Modern Tool Co.....113

Taps and Dies—*Continued.*
Morse Twist Drill & Mach. Co. 59
Nicholson & Co., W. H.....121
Pratt & Whitney Co..... 47
Reed Mfg. Co..... 87
Saunders' Sons, D..... 92
Simplex Tool & Supply Co....109
Smart Mfg. Co., A. J.....110
Standard Tool Co..... 26
Ward & Sons, Edgar T.....100
Wells & Son Co., F. E..... 85
Wells Bros. Co.....110
Whitman & Barnes Mfg. Co.. 91
Wiley & Russell Mfg. Co.....109

Taps, Collapsing
Geometric Tool Co..... 34

Telephones, Intercommunicating
Holtzer-Cabot Electric Co....116

Testing Machines
Sellers & Co., Wm..... 40

Thermometers
Bristol Co.....132
Brown Instrument Co.....117

Thread Cutting Tools
Besly & Co., Chas. H.....127
Blake & Johnson Co.....112
Foote-Burt Co..... 92
Modern Tool Co.....113
National Machinery Co..... 91
Pratt & Whitney Co..... 47
Rivett Lathe Mfg. Co.....131
United Engr. & Fdry. Co..... 88
Western Tool & Mfg. Co..... 99

Thread Milling Machines
Pratt & Whitney Co..... 47

Thread Rolling Machinery
Waterbury Farrel Fdry. and Mach. Co..... 50

Tool Holders
Armstrong Bros. Tool Co.... 86
Billings & Spencer Co.....117
Cleveland Twist Drill Co....132
Grant Mfg. & Machine Co.... 82
Hammacher, Schlemmer & Co. 65
Osgood, J. L..... 93
Pratt & Whitney Co..... 47
Simplex Tool & Supply Co....109
Western Tool & Mfg. Co..... 99

Tool Racks
Wells & Sons Co., F. E..... 85
Western Tool & Mfg. Co..... 99

Tools, Small
See Machinists' Small Tools.

Transformers and Converters
Westinghouse Elec. & Mfg. Co.115

Transmission Machinery
American Pulley Co.....123
Caldwell & Sons Co., H. W.... 97
Caldwell & Co., Inc., W. E....126
Coates Clipper Mfg. Co.....117
Hyatt Roller Bearing Co..... 86
Link-Belt Co..... 75
Morse Chain Co.....117
Niles-Bement-Pond Co....2, 3, 46
Oneida Steel Pulley Co.....123
Poole Engr. & Machine Co.... 97
Rockwood Mfg. Co.....122
Royersford Fdry. & Mach. Co. 90
Sellers & Co., Wm..... 40

Trolley Wheels
Lumen Bearing Co.....104

Trolleys and Tramways
Brown Hoisting Mchry. Co...122
Harrington, Son & Co., Edwin.123
Moore Co., Franklin.....122
Niles-Bement-Pond Co....2, 3, 46
Shepard Elec. Crane & Hoist Co. 123
Yale & Towne Mfg. Co.....123

Tubing, Seamless Steel
Almond Mfg. Co., T. R.....118
National Tube Co.....108
Ward & Son, Edgar T.....100

Turntables
Link-Belt Co..... 75
Sellers & Co., Wm..... 40

Turret Heads
Almond Mfg. Co., T. R.....118

Turret Machines
Acme Machine Tool Co..... 34
Bradford Mach. Tool Co..... 5
Brown & Sharpe Mfg. Co..55, 132
Bullard Machine Tool Co..70, 71
Davis Machine Co., W. P.... 74
Dreses Mach. Tool Co..... 22
Flather Mfg. Co., E. J..... 98
Gisholt Machine Co..... 85
Jones & Lamson Mach. Co., 12, 13, 50
LeBlond Mach. Tool Co., R. K., 63, 132

Turret Machines—*Continued.*
Lodge & Shipley Mach. Tool Co. 4, 16
New Britain Machine Co.....106
Niles-Bement-Pond Co....2, 3, 46
Potter & Johnston.....20, 21
Pratt & Whitney Co..... 47
Prentice Bros. Co..... 29
Springfield Mach. Tool Co.... 49
Warner & Swasey Co..... 44
Windsor Machine Co..... 38

Turret Machines, Vertical
Bullard Machine Tool Co..70, 71
Flather Mfg. Co., E. J..... 98
Niles-Bement-Pond Co....2, 3, 46

Turrets, Carriage
Blount Co., J. G.....111

Twist Drills
Boker & Co., Hermann..... 73
Celfor Tool Co..... 89
Cleveland Twist Drill Co....132
Detroit Twist Drill Co..... 89
Hammacher, Schlemmer & Co. 65
Lincoln-Williams Twist Drill Co. 109
Morse Twist Drill & Mach. Co. 59
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Standard Tool Co..... 26
Union Twist Drill Co..... 67
Ward & Son, Edgar T.....100
Whitman & Barnes Mfg. Co.. 91
Wiley & Russell Mfg. Co.....109

Unions
Dart Mfg. Co., E. M..... 86
National Tube Co.....108

Universal Joints
Baush Mach. Tool Co..... 36
Boston Gear Works..... 96

Valves
Chambersburg Engineering Co. 91
National Tube Co.....108
Watson-Stillman Co..... 95

Vanadium
American Vanadium Co.....106

Vanadium Bronze
American Vanadium Co.....106

Vanadium Steel
American Vanadium Co.....106

Vise Stands
LeBlond Mach. Tool Co., R. K., 63, 132
New Britain Mach. Co.....106
Tindel-Morris Co..... 98
Western Tool & Mfg. Co..... 99

Vises, Drill
Carter & Hakes Machine Co.. 87
Graham Mfg. Co..... 87

Vises, Hand Power
New Britain Machine Co....106

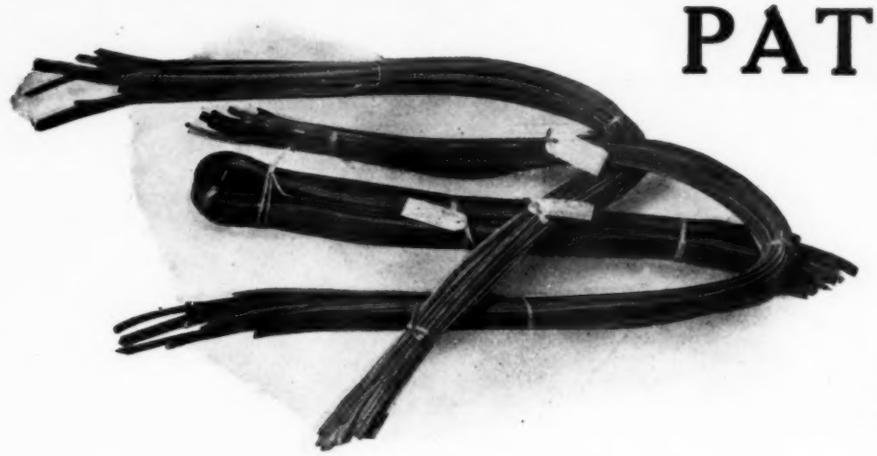
Vises, Metal Workers'
Athol Machine Co..... 87
Brown & Sharpe Mfg. Co..55, 132
Carter & Hakes Machine Co.. 87
Graham Mfg. Co..... 87
Hammacher, Schlemmer & Co. 65
LeBlond Mach. Tool Co., R. K., 63, 132
Millers Falls Co..... 98
Parker Co., Chas..... 87
Reed Mfg. Co..... 87
Walworth Mfg. Co..... 50
Western Tool & Mfg. Co..... 99

Vises, Pipe
Athol Machine Co..... 87
Bignall & Keeler Mfg. Co.... 92
Butterfield & Co.....110
Curtis & Curtis Co..... 91
Parker Co., Chas..... 87
Reed Mfg. Co..... 87
Saunders' Sons, D..... 92
St. Louis Sales Co.....121
Walworth Mfg. Co..... 50
Wells & Son Co., F. E..... 85
Western Tool & Mfg. Co..... 99
Williams & Co., J. H..... 78

Vises, Plain
Graham Mfg. Co..... 87

Vises, Planer and Shaper
American Tool Works Co..... 8
Carter & Hakes Mach. Co..... 87
Cincinnati Planer Co..... 78
Hendey Machine Co..... 61
Niles-Bement-Pond Co....2, 3, 46

Vises, Universal Machine
Becker Milling Machine Co... 23
Brown & Sharpe Mfg. Co..55, 132
Graham Mfg. Co..... 87
Skinner Chuck Co.....119



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Vises, Wood Workers'
Hammacher, Schlemmer & Co. 65
Parker Co., Chas. 87
Pratt & Whitney Co. 47

Voltmeters
Bristol Co. 132

Wash Stands and Bowls
Manufacturing Equipment and Engineering Co. 82

Washers
Barnes Co., Wallace 109
Milton Mfg. Co. 81

Welding
Electric Welding Products Co. 105
Goodyear, Inc., Nelson 108
Sanford Mfg. Co., F. C. 108
Sowers Mfg. Co. 107
Tate, Jones & Co. 108
Toledo Electric Welder Co. 107
Universal Electric Welding Co. 103
Worcester Pressed Steel Co. 103

Welding Machines
Sanford Mfg. Co., F. C. 108
Toledo Electric Welder Co. 107

Welding, Oxyacetylene
Sanford Mfg. Co., F. C. 108
Sowers Mfg. Co. 107

Wire-Flattening Mills
Blake & Johnson 112

Wire-Forming Machinery
Automatic Machine Co. 61
Baird Machine Co., The 88
Blake & Johnson Co. 112
Waterbury Farrel Fdry. and Mach. Co. 50

Wire, Music
Hammacher, Schlemmer & Co. 65

Wire-Nail Machinery
National Machinery Co. 91

Wire - Straightening Machinery
Adt & Son, John 99
Hemming Bros. Co. 99
Shuster Co., F. B. 99

Wood Working Machinery
Greaves, Klusman & Co. 85
Manning, Maxwell & Moore 125
Niles-Bement-Pond Co. 2, 3, 46
Seneca Falls Mfg. Co. 80

Wrenches, Drop Forged
Billings & Spencer Co. 117
Morse Twist Drill & Mach. Co. 59
Page-Storms Drop Forge Co. .. 86
Trimont Mfg. Co. 73
Whitman & Barnes Mfg. Co. ... 91
Williams & Co., J. H. 78

Wrenches, Machinists'
Bemis & Call Hardware & Tool Co. 86
Billings & Spencer Co. 117
Coes Wrench Co. 32
Hammacher, Schlemmer & Co. 65
Morse Twist Drill & Mach. Co. 59
Page-Storms Drop Forge Co. .. 86
Trimont Mfg. Co. 73
Whitman & Barnes Mfg. Co. .. 91
Williams & Co., J. H. 78

Wrenches, Pipe
Bemis & Call Hardware & Tool Co. 86

Wrenches, Pipe—*Continued.*
Billings & Spencer Co. 117
Page-Storms Drop Forge Co. .. 86
Reed Mfg. Co. 87
Trimont Mfg. Co. 73
Walworth Mfg. Co. 50
Wells & Son Co., F. E. 85
Whitman & Barnes Mfg. Co. .. 91
Williams & Co., J. H. 78

Wrenches, Ratchet
Parker Co., Chas. 87
Pratt & Whitney Co. 47
Trimont Mfg. Co. 73

Wrenches, Tap
American Tap & Die Co. 110
Besly & Co., Chas. H. 127
Billings & Spencer Co. 117
Butterfield & Co. 110
Card Mfg. Co., S. W. 41
Carpenter Tap & Die Co., J. M. 110
Smart Mfg. Co., A. J. 110
Standard Tool Co. 26
Starrett Co., L. S. 72
Trimont Mfg. Co. 73
Wells Bros. Co. 110

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